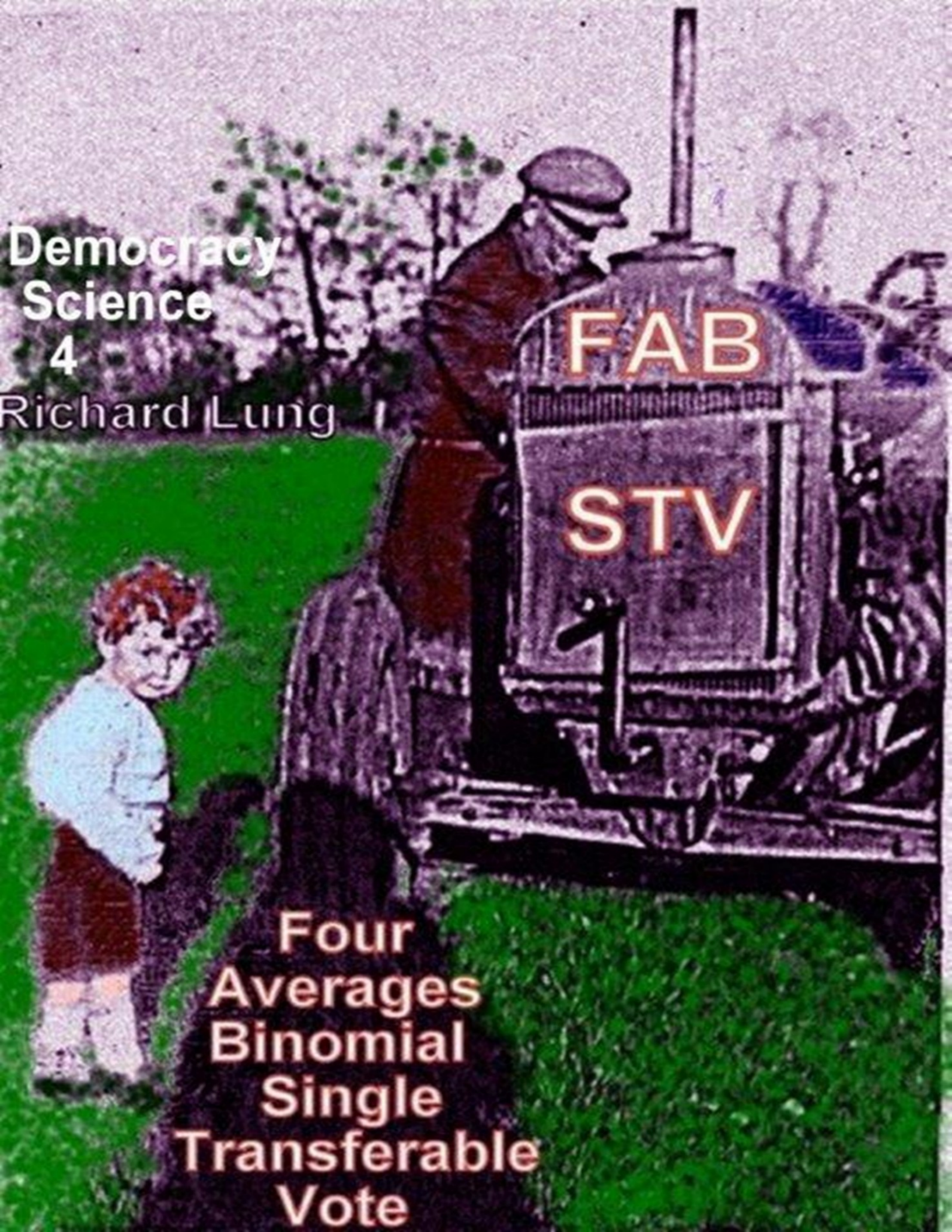
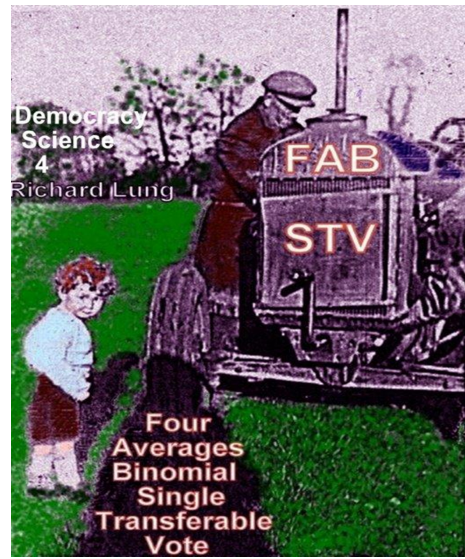


Democracy
Science
4
Richard Lung



Four
Averages
Binomial
Single
Transferable
Vote



FAB STV: Four Averages Binomial Single Transferable Vote.

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First edition.

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FAB STV: Four Averages Binomial Single Transferable Vote.

Quotes.

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I find myself hoping a total end of all the unhappy divisions of mankind by party spirit, which at best is but the madness of many for the gain of a few.

Alexander Pope. 1714.

And this is Law, I will maintain
Until my Dying Day Sir,
That whatsoever King shall Reign,
I will be Vicar of Bray Sir.

Anonymous, 1734: The Vicar of Bray (chorus).

I would be enamored of English institutions were they not utterly undone by the spirit of party.

Voltaire, 1758: Candide.

“In the first place, it secures a representation, in proportion to numbers, of every division of the electoral body; not two great parties alone, with perhaps a few large sectional minorities in particular places, but every minority in the whole nation, consisting of a sufficiently large number to be, on principles of equal justice, entitled to a representative. Secondly, no elector would, as at present, be nominally represented by some one whom he had not chosen. Every member of the House would be the representative of a unanimous constituency.... as the quota might be, every one of whom would have not only voted for him, but selected him from the whole country; not merely from the assortment of two or three perhaps rotten oranges, which may be the only choice offered to him in his local market.”

John Stuart Mill, 1861: Representative Government (on the Hare system).

"In Great Britain we do not have Elections any more; we have Rejections..."

HG Wells: "The Labour Unrest" 1912 (reprinted: An Englishman Looks At The World. Also contains: The Disease of Parliaments. 1914.)

»The health of democracies, of whatever type and range, depends on a wretched technical detail: electoral procedure. All the rest is secondary.«

Jose Ortega y Gasset, Spanish Philosopher.

I have supported, and shall again, in the House, Fair Voting, especially the Single Transferable Vote, inexplicably rejected by the two great parties.

.....no one wants to have in this country some of the queer arrangements they have on the Continent - the Second Ballot, for example, or the 'List System'. They are so bad that I shall not even attempt to explain them: but they are all called 'P.R.', and help to give the poor dog a bad name.

AP Herbert MP, 1946: The Point of Parliament.

"...we let purely party considerations weigh far too heavily in electoral matters.....Unless we develop a more adult and less partisan spirit, we cannot hope to achieve a truly civilized electoral system."

JFS Ross: Elections and Electors. 1955.

"the voter is not in a position to choose either the kind of representative or the kind of government he would like if he had a free choice...his function is the limited and essentially passive one of two alternatives put before him."

Leo Amery: Thoughts On The Constitution. 1962.

(Amery introduced the single transferable vote to Malta, in 1923, despite 90% illiteracy.)

"Elections are for the benefit of the electors not for the political parties or any other interests, and the electors must see to it that they get a system that seems to them adequate for the expression of their views."

Enid Lakeman: How Democracies Vote. 1974.

"I am a 75 year old voter who has participated in every election for which I have been eligible since the age of 21 and whose vote has not once, in all those 54 years, had any bearing on the result whatsoever. To all intents and purposes I feel disenfranchised by the present system. I want to be able to make my vote effective and can see no other way of achieving this than by means of a change to STV."

Written opinion – Public meeting, Cardiff published in the Final Report of the Richard Commission.

Anthony Tuffin: STV Action (quotes.)

"If their job description includes private member's bills, standing up in the House and speaking and voting in "free" votes on their own recognizances etc. how can MPs elected off a party list be truly acting "freely". As Upton Sinclair noted, "It is difficult to get a man to understand something, when his salary depends on his not understanding it." Don't the voters under our Westminster system of

responsible and accountable government have the right and the responsibility to choose effectively at the candidate level to electorally underwrite MPs who are ostensibly expected to act outside party control in such situations? Our new electoral system must elect MPs not parties.”

Mark Henschel (Canadian electoral reformer).

Elections as masquerades of restrictive practises.

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The Single Transferable Vote is the super-vote. FAB STV is the super-vote super-charged.

Introducing the Hare system of STV, John Stuart Mill explained:

"According to this [Hare] plan, the unit of representation, the quota of electors who would be entitled to have a member to themselves, would be ascertained by the ordinary process of taking averages, the number of votes being divided by the number of seats in the House..."

Representative Government requires an averaging of votes per seat. Beyond the Hare system of the Single Transferable Vote, my further invention of FAB STV uses Four Averages, of four kinds of vote distributions, which occur during successive stages of count procedure. This is to the same purpose, as Thomas Hare, of making the result more statistically representative. That is key to election method.

Part two, of this work, shows FAB STV may be the future of electoral democracy. Therefore, existing STV is the way to go. Hence, the promotion, in part one, of conventional STV, granted large enough constituencies for a generous representation of the people.

While seeking to introduce FAB STV, this inventor recognises that, for a long time, traditional STV forms will be the only really effective

(elective) elections in world use. From a scientific view-point alone, conventional STV may provide useful comparative data, even if FAB STV shows an improvement, after sustained tests over many years.

Proportional representation was independently invented as (1, 2, 3, ...) order of choice in the vote and proportion in the election count. Namely, the quota-preferential method or single transferable vote. Order and proportion are thus twin under-pinnings of democracy, as well as of science and the arts, and civilisation in general.

From the eighteenth century, the influence of the Enlightenment was felt till the early twentieth century, as far as electoral method was concerned. The hundred years, since then, has witnessed a gathering Benightenment.

Original Proportional Representation was degraded, from the start, in continental Europe, to a corporate vote for parties, with a spot vote. It takes a number vote to order choice of individual candidates, distinct from the x-vote, made into a blank cheque for some party.

The trend to party dominance of government, observed and predicted by Moisei Ostrogorski, in Britain and the United States, over a century ago, has been amply realised. He also early appreciated the role of transferable voting to reassert democracy. Support for this voting method has persisted far and wide, to this day. And I apologise to all its promoters, past and present, that do not get just mention, here or else-where in my books and comments.

Many alleged reformers have got behind various parties right to be elected, rather than voters right to elect. This, under the banner of proportionality. It amounts to hi-jacking an illiterate x-vote to count for parties, spoils-sharing the seats between them.

Those (party) proportionalists may turn puzzled or pugnacious, by

any intimation that their cause is neither proportional representation nor democracy.

Never mind, they have, going for them, the instinctive allure of following the crowd of countries, for whom party-proportional elections are a time-honored corrupt practise.

At heart, this is no more than a belief that might is right. Power to the parties appears an irresistible mass movement of countries, that is the wave of the future. There is no reasoning with campaigners refusal to get off such an apparently unstoppable band-wagon.

Appearances may be deceiving. The writing is on the wall for the "party vote." Peer-reviewed studies show that party-proportional counts give rise to strategic voting (tactical voting) as much as, and more elaborately than does simple plurality elections (First Past The Post).

From this age of the Benightenment, electoral reform shows signs, at last, of a passing from the darkest hour before the dawn.

It is naive to believe that a multi-party state is different in principle from a one party state or a two-party state (of which Hilaire Belloc and GK Chesterton said, there really is only one party).

Likewise, there is a difference of degree, not principle, between "the leading role of the party" in Communist countries, and the leading role of the parties, in capitalist countries. (This reminds of a remark by Andrei Sakharov, that the Soviet Union was like a caricature of the West.) A multi-party oligarchy still forms "the political class." (This was the term former civil servant Clive Ponting used to describe who governs Britain.)

Conformity or going with the crowd is not always the best option. When absolute monarchy was the fashion in Europe, England chose

instead a constitutional settlement.

No doubt, there was much apprehension about the futility of defying ingrained beliefs about divine right of kings. You get a sense of it, from John Milton, by his "Paradise Lost" with the war against Heaven. Disloyal angels rebel against the divine monarchy, using cannons and other mundane ordnance of the day, before a defeat that has them thrown into prison, which is Hell.

That scenario is why William Blake called Milton "of the devils own party without knowing it."

Things are not always as they seem. Since one-party (at a time) government took over from one-man rule, or monarchy, the divine right of kings has become the divine right of parties.

The nineteenth century rise of the party system with the single member system obliged people to choose a local party candidate, whether or not they want to vote on those prescribed lines.

Twentieth century recognition that party lists, lacking direct elections of individual representatives, might not be sold to the public, has led to an Additional Member System (AMS) or Mixed Member reform which combines the partisan principle of lists or tickets, with the locality principle of single member constituencies.

The Mixed Member Proportional (MMP) system gives an x-vote each for a party list and a single member. Dual candidature is a double subversion for a doubly safe seat system. Its two choices for the voters are actually two chances for the candidates. AMS/MMP completes the subversion of elections into partitions and locations. Two wrongs don't make a right.

MMP is the Emperors New Clothes of electoral reform. The cant is that PR (a euphemism for the spoils-sharing of seats for parties) is alright, as long as there is a local link (a euphemism for single

members keeping their monopolies on representation).
Elections are lost in a masquerade of restrictive practises.

If the political class has sheltered itself from electoral competition, an academic class has covered for them. More than a half-century of academic denial, of right and wrong in election methods, has advertised electoral differences as no more than a matter of personal choice of voting system. Electoral subjectivism makes the world safe for incumbency.

If politicians Refer any personal choice of electoral reform (with the money and the media behind them) they usually talk the public out of adopting personal choice in the voting system, itself. Whatever the change in the electoral system, the safe seats are saved somehow or other.

A moral and intellectual sickness of our age is that an incumbents rebellion against representative democracy has been emboldened by a pseudo-science of electoral scepticism in academe.

What has academic scepticism of democratic elections achieved, in well over half a century? Where is the sceptics standard model of representative democracy? Democratic denial has been a self-fulfilling prophecy. A claim, that there is no law of voting method, serves as an academic alibi for the anarchy of voting methods in the world.

Electoral scepticism uses the truism that there is no perfect electoral system, as an illogical excuse to pretend that there are advantages and disadvantages to every electoral system.

That gives-up, on the scientific ideal, of one true voting system, for making do with any number of indissoluble mixes of truth and falsehood. The academically fashionable "trade-off theory" of elections commands make-do rather than mend.

The twentieth century seems to have contributed little more to progress in a conceptual understanding of elections, than Meek method STV. At any rate, this is the starting point of FAB STV, which takes its key concept of the keep value, and runs with it.

The first part of this book may be suitable for the general reader. The second part is a highly detailed explanation of the super complicated new electoral system. To be done to a high standard of accuracy, STV count procedure is an increasingly specialised subject, that requires as much study as other specialties. No one complains that science is too complicated, so it is ignorant to do so, regarding the refined count procedure of transferable voting.

As HG Wells so much as said, a century ago, regarding the STV count, you might as well expect every driver to be a car mechanic.

Admittedly, there is a good deal of repetition, in my books and comments. Here, I say much the same thing, with some over-lap of material, in my recent submissions to authority, reformer or friend. I regret it, but I regret more, that it still needs to be said to a heedless world. The well-informed have become more numerous but the world flounders in an electoral anarchy of restrictive practises.

This book is my innovation in the definitive method of transferable voting. It is also a celebration of the gallant and original contribution of HG Wells to the history of electoral reform.

In 2018, it is a centenary celebration of "HG Wells law" explained below.

This year, I also published a collection called "The Angels Weep: H.G. Wells on Electoral Reform." (That book contains the three original snaps of Wells and James Barrie and friends, I was lucky enough to obtain.) Wells writings, on "sane voting" and otherwise, are no longer "The Invisible Book".

Part one.

The individual and the group.

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Error-reducing average behavior.

Swarm intelligence was given a screening (on UK tv, 5 February 2018) and it was a catalyst for all sorts of considerations, to do with this work, on the eve of its publication.

Individuals in the mass have that much more energy and power. They also offer a collective source of information, that, on the whole, is more likely to be representative of how to react to some situation, than the behaviour of odd individuals, which could be way out.

The Great War provided a clear example in the benefits of herding ships in convoy, for dramatically reducing shipping losses from unrestricted submarine warfare.

There is a twist to that story, which Winston Churchill narrated. The experts at the Admiralty amassed a tremendous case against the terrible consequences of the convoy system. It was the inexperienced politicians, who said: Well, let's just try it.

On quiz shows, that have an option to ask the audience, they get it right 90% of the time, whereas experts are right 65% of the time.

That would seem to reflect rather well on democracy, and the importance of not merely consulting public opinion but gauging it with the utmost accuracy, which is what this book is ultimately about.

The swarm documentary says that in 1906, came the surprising find that the expert was out-guessed by the crowd. The narrator bravely repeated the experiment, at an agricultural fair. An expert guessed the weight of a cow. He was close. Then the average was taken of all the guesses made by the public. It was closer still.

When you take an average of a range of opinions, the most way-out guesses, at the extremes, or ends of the range, cancel each other out. The mass of guesses are somewhere in the middle. The point, of the average, is to find the most representative guess, in the very middle.

What is “the middle” has a way of moving about with different averages. The first thing one learns, in an elementary statistics course, is the existence of different averages, calculated in different ways, more accurately to represent, or reflect, different distributions of data.

I was three years on such statistics, as part of a social science course. That and methodology, rather than the sociology itself, were the only things I was any good at.

(It was a closely guarded secret that there was anything else but value-neutral sociology – Piterim Sorokin was just a name, who never received a single lecture on his work, in all three years this diligent attender was there. The Nature and Types of Sociological Theory, a standard work by Don Martindale, concluded – wrongly – that the subject had not found its epoch maker, even tho his work relied heavily on a Sorokin book, for the pioneers of the subject.)

Later in life, a mathematics teacher asked me of the statistics: Was it baby stuff?

I admitted it.

Yet, its sustained practice, during my impressionable youth, gave me a grounding and feel for the subject, of which one cannot be confident, from merely reading just another book about it.

The tv narrator, at the fair, took an average, which we think of as “the average.” That is the arithmetic mean. As he explained, he simply added up all the guesses of the cows weight, and divided the sum by the number of people, who made them.

The arithmetic mean is the average of a random distribution, which is so prevalent in collections of statistics, that Francis Galton called it the normal distribution (to which the binomial distribution approximates).

The geometric mean correctly predicts the Michelson-Morley experiment.

The Michelson-Morley experiment (MMX) also uses this average, the arithmetic mean, in calculating the two average speeds of a light beam, mirror-reflected back to source, after being split in two perpendicular directions.

The sensation caused by the conduct of this experiment, in 1887, was that, contrary to calculation, the split beams arrived back at the same time.

This was known, because the apparatus, in question, was a Michelson interferometer. Light travels in waves. If split light waves, on return to source, do not interfere with each other, that means that they are still in sync or synchronised, which means that they have taken the same time of travel.

At one point, while I was still puzzling over this so-called null result of MMX, I remember scrabbling in a corner of my book-shelves, for my old Statistics book, co-authored by my former lecturer, because I vaguely remembered there were other averages than the arithmetic mean.

Sure enough, there were. But the text regarded dubiously the geometric mean, apparently included as a matter of form, even by business professionals.

In his masterpiece, *Social and Cultural Dynamics*, Sorokin takes "the geometric average" of cultural artifacts, indexed by their values, more or less secular or sacred, in order to estimate the societal norm.

I only learned of the particular interest of his work, as a sociology of values, not as a coming-of-age sociology student but, by accident, about the time I received my pensioners bus pass.

I also came across, my school-boy notes for a second ordinary level maths examination, Pure Maths with Mechanics, and these included the geometric mean.

This chance find, like the belated Sorokin discovery, was after I thought of applying the geometric mean to the MMX calculation, and so had no bearing on my discovery.

Lo and behold! Using the geometric mean, instead of the arithmetic mean, to average the light beam return journeys, correctly predicts the outcome of the Michelson-Morley experiment.

The arithmetic mean is a suitable measure for taking the average velocity, for instance of light speed in a given direction.

For, an arithmetic mean is an average of a range of data, which forms an arithmetic series. This involves a constant change in numerical magnitude, (for example, an adding by two) from one item to the next, over the whole range of items.

The geometric mean averages a geometric series, which involves a constant change in the change (for example, a multiplying by two) of numerical magnitude from one item to the next.
(Simple numerical examples are given in a later chapter.)

In MMX, the split light beams are reflected, thus changing their direction, so there is a change in velocity, with respect to direction.

Velocity is an example of a vector, which means it is a combination of magnitude and direction. Magnitude means greatness, in this case, of speed.

Light has a constant speed, or constant change in position over time. In MMX, mirror reflection further changes light beam direction, so there is a change in a change (either acceleration or deceleration) in its position over time. Altho light does not change its speed, meaning there is no acceleration in its magnitude, the mirror reflection creates an acceleration in its direction.

Therefore, the suitable average for MMX should be the geometric mean, averaging a geometric series, where there is a change in a change, or acceleration, in the direction component, tho not the magnitude component, of the vector.

When I first discovered that the Michelson-Morley experiment should have used the geometric mean, instead of the arithmetic mean, for its predictive calculation, I was quite excited by it. Naturally, I tried to notify the physics community. Little me has found something out that those geniuses didn't know, for well over a century!

To cut a long story short, one comes up against the brick wall of so-called peer review. Not being a “peer” I couldn’t get reviewed, by the staff of any respectable or prestigious journal. They just ignored me. Science can be ignorant.

In 1215, Magna Carta gives the right to be judged by one’s peers. But there is a refrain to the clauses of that document: “Except for the common people.”

Dorothy Cowlin told me of an act, on the radio, in the 1930s, who made a song with the chirpy refrain: “Except for the common people.”

I admit that, statistically speaking, and this is a book about statistics after all, it makes sense for qualified people, to cut-out or ignore the people unqualified in their specialty. I am likely to be a waste of their precious time, because I am confessedly just plain ignorant and incompetent with regard to the arduous discipline of acquiring the mature science skills that go to making a physicist.

To put things in perspective, however, I have put in the hours of reading and study of popular physics books, not to mention what little I could glean from more technical works, for most of my active years.

As for approaching individual professionals, you have to consider that they may be besieged by wannabe contributors like me, or just have a high public profile, that takes up their time, or just be plain busy with a strenuous work schedule: physics is not a soft option.

Moreover, a professional has nothing to gain reputation-wise from recognising some white crow like myself, and everything to lose, reputation-wise from being professionally derided for believing in a white crow.

Yet, there is also a down-side to a specialty's pragmatic exclusiveness. It tends to justify denying the worth of contributions from out-siders. And perhaps ignoring or pretending not to see them. Only specialists may be allowed to know anything. ("She is no better than she should be.") Specialists may be wrong.

Churchill contrasted Britain with Germany, in this respect. In the Great War at sea, the British government questioned its experts and made its own decision, which proved right on convoys.

The German government would never question the authority of its experts, that the u-boat campaign would blockade Britain decisively. The experts were wrong again.

I posted on a physics forum, that tolerated amateurs. As far as I know, no one commented. Apparently, my Geometric Mean amendment, of the MMX calculation, was avoided like poison.

One post, I attempted online, was blocked by the physics moderator, who treated me like a krank, on the grounds, that not only the physics text, he over-saw, but nowhere else in physics, that he had ever come across, was the MMX calculation done the way that I'd done it.

At least, he inadvertently credited me with originality!

In-group tribalism.

In-group tribalism is a tremendous anti-social force. Adam Smith made the classic observation that whenever members of a profession come together, it seems but to be to hatch some conspiracy against the public. Bernard Shaw went so far as to call the professions conspiracies against the public.

Politics, as a profession, is bound to be a conspiracy against the public, to prevent people from finding out election method that removes the sinecure of safe seats. HG Wells briefly but tellingly characterises this situation, in a late book (1942): *The Outlook For Homo Sapiens*. Indeed, such obscurantist politics concerns "HG Wells law" (discussed below).

Margaret Heffernan authored *Wilful Blindness*, which made evident the compulsion to cover-up and protect ones colleagues, however damnably incompetent and dangerous to the public. I know that the examples, she gives, are fully justified, because, in my naive youth, I fell foul of a serious instance. Other unfortunates much more so.

Heffernan sums-up the in-group attitude or tribalism, when she quotes the professional, who is driven to retort that he wasn't going to shop a colleague, tho he regarded him as unfit for the job, and a public menace.

When normal people behave in this inappropriate way, it is apparent that their reason is unconscious of, and therefore has not allowed for, forces of instinct that are impairing their judgment.

In my case, I was told that it was "the profession protecting itself." It was evident, even to my young self at the time, that the profession was condemning itself. But I did not know how unscrupulous, under the tribal influence, good people could be.

The tribal mentality seems to go something like this: Their errant colleague is a rogue, but if he is thrown out of a job (as he fully deserves to be) then so might I be, under this unfortunate precedent.

One colleague would even go so far as to tell me, of the rogue, that "He must be paid." The government department had different ideas.

But the profession fobbed-off the independent inspector with a less dire example of the rogues misdeeds.

God knows how long he was allowed to go on wreaking havoc with the public. Many years later, such a case was reported in the local newspaper. It was probably the same man. There cannot be that many about! He was portrayed as a villain. There certainly was something very much wrong with him, not least from a psychiatric point of view. (From which, may the grace of God preserve us.) I blame not so much the misfit, as his profession, which was made up of normal sane people, who yet insanely abdicated their responsibility to strike him off.

The disjoint, between how people treat each other, as individuals and as groups, would suggest strongly that our institutions must not allow groups to over-run individuals.

I found out from first-hand experience that mature kindly intelligent and dutiful individuals may not respond so, as an organisation.

That description might be a fair characterisation of President Franklin Roosevelt. Yet even he perhaps fell a prey to the human instinct of tribalism, when he infamously, if honestly, said of a Latin American dictator: He may be a son of a bitch, but he's our son of a bitch.

The in-group, as closed shop, may amount to passive aggression, determined that what we have we hold. It is as intractable and obstructive, in its way, to public well-being, as aggression most obviously is, in its active, manifest form.

If there is tribalism within civil society, then how much more so is there, between nations or super-tribes and ethnic rivals?

Tribalism was the human way of life for hundreds of thousands of years. People survived in tribes, scraping a living, if necessary

against each other. "My tribe right or wrong" must have been the self-preservation imperative long before "my country right or wrong." In the movie, *Dances With Wolves*, one of the native American tribes launches a surprise attack to steal another's winter food store.

That great Republican, Bernard Shaw, remained blinded by partisan bias. In a late nineteenth century letter to Ellen Terry, he advises her that right and wrong is no more a consideration than East and West, and that she should go all-out for her own course of action.

Hence, Shaw recognised the Bolshevik revolution as his side, and went all out for it, no matter what its crimes. (Tho, he did make some pertinent criticisms, in the preface of *Too True To Be Good*.)

Margaret Thatcher perfectly captured partisan sentiment, when she dismissively remarked of a supposed colleague: He's not one of us.

Thatcher herself was an outsider to the Tory party, importing her dogma of Thatcherism. George Brown predicted, at the beginning of her leadership, that the grandees, who were the real Tory party, would remove such an intransigent. It took a lot longer than he expected. But he was ultimately right. Hugo Young appreciated the significance of her throw-away remark, by entitling her biography: *Not One Of Us*.

Britain in 2018 appears to be in for another round of the battle of privatisation dogma, with its opposite, state nationalisation, both written on tablets of stone, like the "Ed (Miliband) stone" at the 2015 general election.

Professor Finer characterised this adversary politics, as a product of winner-takes-all elections. It is a self-righteous system of allowing one party view-point all its own way, in government, subject to an intellectual removal van, when the other party sweeps to power. Anthony Wigram, a founder of Conservative Action for Electoral

Reform (CAER) published, in 1975, a collection of academic essays on Adversary Politics and Electoral Reform.

Wilful ignorance in government is plain discourteous, divisive and dysfunctional. The evidence is that a ruling few ignore the interests of the many, so the moral is that science depends on democracy.

Labour was a rigidly regimented party, because its strength lay not in individuals but in unions, by which the mass funding of poor men could match the wealth of capitalists.

HG Wells observed labour obduracy, in an episode, in his novel, The Holy Terror.

It is only as free individuals that we can transcend group loyalties. Human unity ultimately depends on liberty from all lesser group loyalties. Bertrand Russell said "Remember your humanity. Forget the rest."

Time Tribes and The Twilight Zone.

Paul McCartney song, Yesterday, is a testament to the tribal touchiness of mankind, if ever there was one. Judging by its phenomenal popularity, it resonates with a wide-spread experience of instinct or impulse trumping answerable conduct in relationships. (I call it "Yesterday syndrome".)

McCartney revealed that he dreamed the song. This was also true of the Keith Richards composition: Satisfaction. Only on play-back, did he wake-up to the fact that he'd composed it!

A similar story is related, by Joan Baez, who, unbeknownst to him, got one, of a series of compositions, that Bob Dylan was churning

out, broadcast. When Dylan heard it, on the radio, he commented that was a pretty good song.

Baez retorted: You wrote it, you dope!

My friend Dorothy Cowlin had a Joan Baez LP (Long Player). She didn't know about Bob Dylan. Well, I told her, one of his songs is on this record: It ain't me, Babe.

I vaguely recall, she said to play it, then. Because, afterwards she approved of this obscure busker.

The Nobel Prize for literature was awarded Bob Dylan at 70. He received a somewhat sharp prompt for not stepping forward with alacrity.

I sympathised. At nearly that age, I don't do alacrity, either.

You might wonder where had Dorothy been, not knowing of Bob Dylan?

Well, she was not ignorant of music. She came from a musical family, which maintained a tradition of good amateurs. In her youth, she entered a national competition, as a pianist. While not rating herself, she did say it was a particularly talented year, including Kathleen Ferrier amongst other notables.

In folk music, Ferrier would be as much regarded, in her day, as Joan Baez, in hers, which is saying a lot for both of them.

We are trapped in our time tribes. All the arts appear to gather into groups, coteries, movements, which are more likely to be noticed than individuals, however talented. It is the swarm effect again.

Each new generation is a time tribe with a distinctive artistic fashion or culture that may just about last for a decade. For a similar period, each wave of youth has its window of opportunity to find partners

and establish itself, before comes the turn of the next time tribe, that only knows its own milieu. In other words, eligible individuals may gain a social momentum by sharing the cultural identity of their generation.

The thing about that song again, "It ain't me, Babe", is that when Baez sings it, it sounds like a rousing feminist anthem. That would be just up Dorothys street.

When Dylan (or any man) sings it, it sounds like he has more important things to do, than courting.

Desmond Morris would have been better off, on one occasion, if he had followed Dylans advice not to open doors for a woman. On passing thru, she gave him an ear-full of her displeasure, at his patronage.

Desmonds old world courtesy was a tribal tabu to militant feminism. That story, from The Naked Eye, shows a more relaxed and humorous Morris, not pretending to be a scientist (I didn't say falsely pretending – he's a good one).

The book ends with a particularly happy piece of advice, which quote prefaces my third book on electoral reform and research: Science is Ethics as Electics.

This is my fourth venture on the subject (not counting the booklet in French: Modele Scientifique du Proces Electoral).

The Twilight Zone between waking and sleep is thought to be especially creative. What is true of individual psychology, as recalled by those 1960s popular musicians, has an intriguing parallel in the sociology of Piterim Sorokin. He charts, over the centuries, the alternating rise and fall of cultures, dominated by either a sacred or a secular ethic. The brief transition periods, the twilight of one, before the dawn of the other, achieve a temporary delicate balance, marked

by an extraordinary cultural flowering. A clash can be creative, as well as destructive.

Freedom of the individual.

Disagreements on matters of dogma or doctrine, including secular beliefs, religiously held, can escalate into open conflicts. This problem is not improved by suppressing disagreements. That is an abandonment of all hope in mature dispute, for a determination to treat people like minors, unfit for democracy.

Censorship or a tabu on dispute has been carried out by some electoral reform pressure groups since the 1970s. Their excuse is that they avoid divisive sectarian dispute. Tho they don't dare say so, they are the boss and they will have no challenge to their prejudices. It is both undemocratic and unscientific, because, as physicist, David Bohm commented, in his experience, progress in learning came from questioning ones assumptions.

When the mass of the group are free to find their way, they are all contributing an observational input to the general will. When the mass are regimented and controled by a central directive, all are at the mercy of the deficiencies of some particular point of view. Swarm intelligence has to be free to work.

Science progressed when principles were required to be fully accountable to evidence, with a (democratic) tolerance for observations, that did not fit top-down systems of thought. You find this awareness in the Autobiography of Charles Darwin, looking for contrary evidence, and when Albert Einstein discusses the principle theory (in the collection, Ideas And Opinions).

Pressure groups propagandise the wisdom of following the crowd of countries, practising party-proportional elections. This ignores their supplanting of voters breadth of personal choice, by a party list-making few. Altho proportional partisanship is prevalent in the world, that does not make it representative of its peoples.

Esprit de corps is all very fine in conflicts, where each side are helping their own, and even sacrificing themselves for their comrades.

However, we hope to get away from wars, class wars and destructive animosities. In democratic institutions, it does not help, if elections are conducted on a basis of party loyalties, with no opportunity for voters to transcend such tribalism.

The transferable vote uniquely transcends partisanship, by allowing voters an order of choice for individuals from any social group, not just party.

The 1940 Declaration of Human Rights, provides for voting methods that give effective expression to individual choice.

This charter was initiated by HG Wells. He repeated, in 1942, his formula of proportional representation with the single transferable vote in large constituencies.

The Sankey declaration was the result of a popular debate on war aims to promote peace. It has much to recommend it, in this electoral and other respects. It prohibits speculators (the petrol sifoners of the economy).

Such a constitutional provision might have served the country well against the recurrent "fleecing the lambs" by the financial sector. It is regrettable that it was never officially adopted, with its own constitutional court. Britain recently instituted a Supreme Court but it still hasn't a document to compare.

The Sankey declaration could still be made a legitimate legal

document, upon which the Supreme Court might base its determinations, without prejudice to a possible contemporary version.

The Irish constitution and the Scottish draft constitution both entrench the single transferable vote. Australia has a constitutional provision that only allows candidates to be directly elected as individuals.

The version of STV, explained in this book, FAB STV, is much more sophisticated than traditional STV. But my purpose is not so much to replace the latter, which is much the best system in existence. FAB STV is meant to promote existing STV, by showing its unique potential for radical evolution, in election science: the knowledge of freedom and the freedom of knowledge.

Nothing could be further from the truth than the propaganda that everything in the party-proportional garden is rosy. That is not the way to go.

The new Index on electoral freedom says most of the world does not score particularly well in the matter:

"In fact, only Ireland, which leads the 2018 ranking, reached an outstanding level of electoral freedom, slightly exceeding the 80 points out of a maximum possible 100. Among other virtues, Ireland is one of the few countries with a single transferable vote system, which, according to the recently deceased professor Sartori, is the purest of all, and, in his opinion, perfectly proportional."

Sartori, G.: Ingeniería constitucional comparada. México, FCE, 2003, p. 3.

World Electoral Freedom Index 2018.
The state of democracies at a glance.

Professor Pangloss on the best of all possible worlds (for electoral anarchy).

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If crowd opinion can, on average, out-guess the expert, this study is of how to measure it most accurately in a representative election system. A count that averages the vote, four different ways, in the evolution of the count, makes for a more representative method of election than hitherto.

While we may want to maximise the import of the democratic vote, the invention of the count (or any invention) may not come from crowds. (At least not until there is "Interactive STV" discussed in my book, Scientific Method Of Elections.)

At any rate, we cannot do without special studies. Public debate on voting method, the world over, has been notorious for its poverty of understanding. Debate gets off on the wrong foot, and stays there. Ignorance may be ignorant even of what it is ignorant. Electoral reform has not just a velocity of ignorance, it has achieved accelerated ignorance!

The Westminster Hall debate, on the Make Votes Matter (MVM) petition, for proportional representation, to the UK Parliament, in 2017, showed the status quo. UK government MPs were determined to hold fast to First Past The Post elections, over-representing the Tory party.

Whereas reform, as usual, came over as a self-righteous call for a redress to the partisan balance of power. That would ensure voting

power to the parties, not voting power to the people. It was the monotonous in-house party squabble, not a debate for representative democracy.

The MVM pressure group repeated the forty-year old tactic of its predecessors, (the National Campaign for) Fair Votes, and Charter '88. They insisted that party, but not all society, be served by the PR principle. This makes of PR no longer a principle but a party privilege.

On the Conservative Action for Electoral Reform (CAER) website, listing Tory supporters of electoral reform in 1974, absent (when I looked) was the name of Ian Gilmour (later a Sir). In his book, *The Body Politic*, he says: "Censorship is nearly always ridiculous."

This is why electoral reform campaigns have been ridiculous for over forty years. Fair Votes and Charter 88 (yes, and the current Make Votes Matter) refused to discuss the actual reform to replace FPTP.

John Selwyn Gummer asked Tory party conference, in the 1970s: Have you noticed how you can never pin them down to an actual system?

Margaret Thatcher was listening keenly and later made the same point (reported in ERS journal *Representation*) that electoral reformers were not agreed on an actual system (to replace the existing one - lack of practicality).

All credit to CAER that they answered this criticism with the Single Transferable Vote.

Unhappily, some other party proportional pressure groups, campaign to spread their "modern" partisan elections all over English speaking countries. They are no more modern than a nineteen thirties

dictatorship sweeping aside impersonal party lists.

They quote academic surveys of how prosperous (and even happy!) are the lands under party share-out states. They have the parties monopoly on representation but no monopoly on economic growth, in an era of globalisation.

Credulous attributions of election method to national success lack rigorous demonstration. Germany was an industrial power-house, long before its ridiculous Mixed(-up) Member elections, rather than its vicious autocracies. The Allies post-war bestowal of industrial democracy was a more credible source of economic progress, contrasted to British labour strife and stagnation.

The partisan focus lacks the spiritual values of democracy, in liberty, equality and fraternity. (Party democracy or party equality is an oxymoron.)

Partisanship is magically transformed into a wonder of co-operation, when it comes to (protracted) post-election formations of government (in which the electoral system gives voters little or no say).

Hence, the apologetics for the epic struggles of Angela Merkel to form grand coalitions (not so grand anymore). The bargaining took six months, after the 2017 election. Countries with lower exclusion thresholds and therefore more parties often take much longer. The Netherlands has a permanent official facilitator of coalitions. Their government formations last as long as some governments.

This process allows the caprices of small parties, like New Zealand First, to determine the government.

The (party) proportional case is largely empty assertion that the grass is greener on the other side. Para-party campaigns help-on the organised publicity, mainly of collectivist parties, so that the popular fallacy prevails that proportional representation is nothing more than proportional partisanship, which is treated as all that matters.

Konrad Lorenz liked to refute a hypothesis, every morning before breakfast. Too many alleged reformers like to coddle and cling to their silly rose-tinted fantasies of multi-party states. You have to look elsewhere for all the things that go wrong with them.

The over-laws of electoral reform (restrictive practises).

- 1) Incumbency over-rules intelligence.
- 2) Fashion over-rules logic.
- 3) Partisanship over-rules representation.

1) The first over-law of electoral reform is that incumbency over-rules intelligence. ("Turkeys don't vote for Christmas.")

The less power the voters have to remove office-holders, the greater their desired job security. Therefore, the stupidest, most ineffective, inefficient sham of an election system, that career politicians can get away with, the better they like it. The Mixed Member Proportional system is a masterpiece of misrepresentation. MMP (aka AMS) is the How Not To Do It, by scientific method of elections.

2) Fashion over-rules logic is the second over-law of electoral reform.

You cannot elect an election, because you have to know how to elect it, and if you know that, then the choice of election is a redundant question.

Election method is not a fashion statement. The intention, to make it such, leads to manipulation of public opinion. A poll on voting method reflects on the voters, rather than the voting system.

Referendums on electoral reform educate the public into the best system of ineffective voting, more often than not.

The electoral referendum is not a test of the popular will, but a test of how to apply that will. And how easily the parties can dupe it.

One notices the personal choices of voting methods, made by politicians, who control these matters, is their preferred systems usual lack of personal choice for the voters.

3) The third over-law of electoral reform is that partisanship overrules representation.

Preventing the voters choose the individuals, they want to represent them, is achieved by the monopolies of single member districts and party list monopolies of the single-preference x-vote. Both monopolies make the Mixed Member Proportional system a doubly safe seat system, of dual candidature.

Electoral Reform as a Faustian bargain.

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Forty years of electoral reform campaigns, in Britain and Canada, criticised the current FPTP system but reserved the right not to be criticised, on an actual replacement. It's like a fight in which they insist their opponent has a hand tied behind his back.

Reformers have something to hit: FPTP. Their opponents may have nothing to hit, no actual system, beyond a promise of "proportional representation." Some electoral reformers, who consider they are for fairness, don't know the meaning of the word, let alone of proportional representation.

Governments can conveniently spring their own pet system of incumbents PR, like MMP, because there is no history of exposing its faults to the public. Like the hapless creatures on Animal Farm, people have no idea what an Orwellian imposition are party lists: all voters are equal but party voters are more equal than others.

When we hear talk about "a fairer voting system" or "(some form of) proportional representation" you can be fairly sure that you won't get either. The vagueness of this social contract gives it away as a fraud. The essential condition of a proportional count is a preference vote. So, vote riggers routinely deny one or the other, to sabotage electoral reform.

Simple plurality may be an inequitable system but at least is not a vote for virtue, which is all the promise of the principle of "proportional representation" means. In fact, a locality application of proportional representation, is found in equal constituencies, as proportional representation between single member constituencies.

Typical electoral reformers solutions are themselves part of the problem. Pressure groups for proportional representation usually promote their own partisan tunnel vision of what PR is. Beware of party-heads bearing gifts. Gifting the people a "party vote" is a Trojan horse or Faustian bargain, in exchange for the party lists taking the power to own your vote for individual candidates.

Mathematicians for transferable voting.

In his book, *Rebuilding Russia*, Alexander Solzhenitsyn did not favor rule by parties, because the parties are only a part. The author, of the *Letter to Soviet Leaders*, was still an environmental progressive, concerned with the general welfare. As an opponent of dictatorship, he prudently pointed-out that Lenin favored party list proportional

representation, which is a party boss system of filling parliaments. This is no worry to many Western electoral reformers, who appear innocent of concerns for liberty.

Yet Solzhenitsyn does not mention the voting system that gives power to the general voting public, rather than the parties, almost certainly because, like almost every-one else, he knew little or nothing about the STV system, not used on the whole continent of Europe.

People often have to make decisions based on imperfect evidence, but we cannot make good decisions based on downright deficient and degraded evidence, amounting to misinformation.

The swarm consensus may out-wit the expert, but is not a substitute for personal training. You wouldn't ask the general public to teach a specialty. That applies to anything from knitting jumpers to string theory. Engineering does not require a popular vote on rocket science.

In his best seller, *The Double Helix*, James Watson said there were only a handful of people in the world, who mattered for the discovery of the genetic code. These were, besides Francis Crick and himself, Linus Pauling and Rosalind Franklin.

It is true, as Werner Heisenberg said, that any science ultimately must be accountable to the public, by being able to demonstrate the validity of its work, or its work is worthless.

I was going to apologise to the general reader for intimidating those of you who may have a phobia about mathematics. Then I remembered that this study is an approach to the elaborate statistics of Four Averages Binomial Single Transferable Vote (FAB STV) for which only a computer would be fast and efficient enough. At none of

its many stages is more than basic arithmetic involved, tho the last stage involves work with powers to base two.

I would not expect anyone, but people with a specialist interest, to study seriously the second part of this book. Never the less, all the information is there, on FAB STV, completely open to all for a studied judgment.

Election method is a young science. It is fairly easy to demonstrate the basics of the logic of choice. Much easier than some current mathematical analyses would have us believe.

It helps to have learned to think, from training in a common sense philosophy of scientific method.

It is ironic that a historical cluster, of mathematicians of election method, has been dimmed by the stellar reputation (in his day) of Thomas Hare, the odd man out, without a mathematical lineage. Carl Andrae anticipated what JS Mill first called "Mr Hare's system." That is the proportional count of an ordered vote (choice 1, 2, 3,...) called the quota-preferential method in Australia. (Australian mathematician, Edward Nanson used the term preferential-quota, in an 1899 booklet.)

In Scandinavia, STV is known as the Andrae system. But Scandinavia has hardly ever used it, since its early days in Denmark. After the 2008-9 global credit crash, Iceland elected a special assembly of citizens, by this method. They hired, to conduct the poll, Dr James Gilmour, a veteran Scottish returning officer, which is to say an heir of the Hare system. Admittedly, Scotland is nearer to Iceland than the bulk of Scandinavia.

Making democracy more representative was made possible, in the eighteenth and nineteenth century, by innovations in election methods. Research and reform was conducted largely by

mathematicians, or the mathematically educated, including Marie Jean Antoine Condorcet, Jean Charles, Chevalier de Borda, and Pierre Simon Laplace, in France; Thomas Wright Hill, John Stuart Mill, HR Droop, Henry Fawcett, Leonard Courtney, in Britain; as well as Carl Andrae, in Denmark; JB Gregory and Andrew Inglis Clark (engineer), in Australia; and Clarence Hoag and George Hallett, in the United States of the early twentieth century.

Hoag and Hallett are the authors of the classic “Proportional Representation. The key to democracy.” They quote HG Wells, from 1918. It is significant that his 1916 essay is called “The Elements of Reconstruction.” Experiment In Autobiography tells that, in youth, Wells was fascinated by the Elements of Euclid. Altho no mathematician, he was still influenced by mathematics, in his reasoning that voting method is “not a matter of opinion but a matter of demonstration.”

For over a century, this had been the established scientific viewpoint. Laplace produced a proof to decide between the methods of Condorcet or Borda. There is one truth not two. Or as Wells concluded a brief explanation, in so many words: there is one right method of voting and any number of wrong ones.

There is an Internet-age discipline called data mining (data retrieval). This typically uses an algorithm in the form of an election system, to turn-up representative results to a keyword input to a search engine.

American data miners tended to use the simple plurality voting method or First Past The Post. They informed colleagues that other methods existed, applying Condorcet and Borda, and other variants of ranked choice voting.

To this old student of voting method, reminder, of these antique systems, was rather like being told that transport is not only possible

by the horse and trap, but also by canal barge and Montgolfier balloon.

This books cover humorously likens my invention of FAB STV (Four Averages Binomial Single Transferable Vote) to my Grandads old second hand tractor! (I know not how long before FAB STV compares more to the old tractor than a pan-mobile of voting methods.)

By the way, I believe that FAB STV offers a new systematic approach to data retrieval. Its potential for efficiency, in this respect, is perhaps its main selling point. It is far more sophisticated than current lax standards of elections. Traditional STV itself is incomparably better than the general information poverty of the worlds main election systems.

Election method critics without method of their own.

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The Enlightenment made mathematicians into the unsung heroes of electoral progress. Our subsequent Age of the Benightenment has seen mathematicians more like a Professor Pangloss impossibilist of democratic elections.

For over half a century, a new school in the mathematics of elections, also stemming from the axiomatic method of Euclid, that influenced Wells, has derived practically the opposite conclusion.

That is why modern academic practitioners of election mathematics cannot be called the mathematical school. There is an other, earlier one, they largely over-look. The later branch I call the sceptical

school. (The former I regard as the Enlightenment or classical school.)

The modern academic movement is identified as Social Choice theory. I was told that it is much wider than that, but a more generic name was not given. Popular presentations of this doctrine usually start off with the maxim that: There is no perfect voting system.

Whoever said there was?

What science ever pretended to have the perfect system or theory?

One's suspicions increase, when the assertion of imperfection leads to the non sequitur, or jumps to the conclusion, that, therefore, every voting method has its advantages and disadvantages.

One might as well say that the truth cannot be refined from the miscellany of voting methods, being indissoluble mixes of truth and falsehood. With no objective way of agreeing on which is the best, this would reduce voting method to unbridgable choices.

In the United States, proportional representation by the single transferable vote was ruthlessly hounded, by party machines, from some two dozen city governments. The only survivor was Cambridge Massachusetts, after defeating 6 abolition referendums in 16 years. The state government still bans the use of STV anywhere else in its jurisdiction!

In their inter-war years classic, "Proportional Representation. The key to democracy", Hoag and Hallett likened this inveterate restrictive practise, to treating STV/PR like an "infection."

The Disease of Parliaments, as HG Wells called an essay, is such restrictive practises, by law-makers, against electoral competition, effected with STV.

The history of electoral reform is of the huge hostility, from the political profession, to “effective voting.”

To add insult to injury, this mugging of method has produced no corrective standard model of electoral efficiency, rather an academic apology for the anarchy of election methods in the world.

Professor Pangloss returned, from the Voltaire classic, *Candide*, to tell us that this is the best of all possible (electoral) worlds. Indeed, the most famous edict of Social Choice theory was an “Impossibility theorem” of democratic elections, as a reasonably consistent system.

The actual author was Kenneth Arrow, and the theorem is named after him. He was working in 1950s America, when the likes of Tammany Hall, that by-word for political corruption, vanquished (STV)PR from the face of the continent. His theorem does not even take into account elections with a proportional count, only over-all majority decisions. (Iain Maclean: *Democracy and New Technology*.)

A naive, over-blown claim has been trumpeted, that a consistently democratic electoral system be denied, by the “Impossibility theorem.” This is the contrived conclusion of an axiomatic system that is not itself an election method - unless implicitly the Alternative Vote. AV is too primitive a standard for judging other voting methods.

Thus, the theorem has the narrowly majoritarian view-point of its country of origin, oblivious to proportional representation. Majoritism is what sociologists call ethnocentric. True, the likes of Tammany made democratic elections all but impossible. Social choice theory might well be characterised as the Tammany apology.

Social Choice theory is worse than status quo science, it is accessory science, because it covers for a devastation of democracy. Some just like to be on the side that is winning.

Impossibilism was an academic after-shock of party machine degradations to American city democracy. Inevitably, Impossibility theorem won a Nobel prize.

The genesis of theorem Arrow can be traced back to Kurt Godel, with his Incompleteness theorem. This laid certain logical limitations on what could be known about the truth of statements, even in the most rigorous system of deductive logic.

Godel came to his conclusions after a study of Principia Mathematica by Bertrand Russell and Alfred North Whitehead. Godel, and others before him, denied Russell the certainty, he sought in knowledge, according to his Autobiography. His system of mathematics, based on a foundation of logic, was named after the masterpiece of Isaac Newton. The Newton universe was a deterministic universe.

The subsequent quantum universe is a statistically based universe, that offered probabilities, rather than determinations. Over the past century, there has been less reason to impose a deterministic model on election method, to emulate natural science. Quite the contrary.

As late as 1960, Ernest Nagel argued for the deterministic model, in his monumental opus, The Structure of Science. He was a straggler. In the inter-war years, the physics consensus decided in favor of Neils Bohr against Albert Einstein, in the debate on classical determinism versus quantum uncertainty.

However, a deterministic assumption traveled down to Kenneth Arrow, who assumed that if election results were not strictly logical, under certain reasonable assumptions, then democracy was somehow "impossible," at least from a purist or purely scientific viewpoint.

The reasonable assumptions were designed to encapsulate elections as deterministic systems, then to show that they could not so be determined.

One dubious provision is for voters having equal preferences -- which is, so far, a suspension of election. The purpose of an election is to elect, not to not elect. It is impossible to call elections "impossible" by foisting a provision for them not to elect.

Equal preferences are not a necessary condition of an electoral system, and cannot be used, as such, to demonstrate their deficiencies.

The sum of logical possibilities for equal preferences between multiple candidates is calculated by the multinomial theorem. This sum rapidly becomes so large, that one can begin to consider how long before voters are required to know more about candidates than the sum total of information in the universe! This theorem is supposed to be a perfectly general, remember, and so is vulnerable to *reductio ad absurdum*.

Perfect knowledge is not a reasonable assumption. It is a practically impossible assumption. As such, the impossibility theorem is impossible.

Much the same might be said of merely exclusive ranked choices, whose number of permutations, measured by the factorial of the number of candidates, (a small subset of the multinomial theorem) still soon becomes an astronomical figure.

Here, too, the complexity of possibilities precludes the voters making perfectly informed decisions (while yet being able to make reasonably informed guesses).

The impossibility theorem is widely assumed to be logical. (An army of academics and teachers repeat it, as if it were an infallible

catechism.) However, as the voters do not have perfect knowledge, they cannot fulfil its (rather imperfect) conditions for demonstrating that there is no perfect electoral system. It cannot be determined what is not there to be determined.

Of knowledge in general, it may be said that we do not know even what we do not know. Perhaps, most of all, we do not know what we do not know. (This may be what the multinomial theorem implies.) Therefore, there seems little point in tasking the voters, with recording, in equal preferences, to know what they do not know.

Non-elective equal preferences are irrelevant to the purpose of an election (tho they be relevant for some uses) which is to record who we do know that we prefer. Voters should be allowed not to know what they don't know: Preference abstentions record imperfect knowledge. Counting them (when they occur) is a necessary condition, for my invention of Binomial STV, to work.

It is commonly repeated that social choice theory reveals STV to be "non-monotonic" which, in plain English, means it can come-up with perverse results. This is a theoretical objection which never has been substantiated in practise.

A contrived example, to show that conventional STV is non-monotonic, is given in Supplement 2. To this example, I have applied FAB STV, which is shown to be "monotonic."

The theorem approach, which became known as social choice theory, and I likened to Professor Pangloss, was based on the axiomatic method of theory building. The classical example is Euclid: Elements of Geometry. Euclid was the mature outcome of thousands of years of practical land measurement. Modern axiomatisers are not all that familiar with the nature of elections.

Elections are not a deductive system of proving who the voters definitely wanted electing. The voters generally do not and cannot know that for sure, except in extreme or simple cases. Instead, elections are a statistical distribution of votes, the aggregate of whose intentions can only be more or less probably ascertained.

Mathematically trained election methodologists persistently come-up with any number of axiomatic fixes to problems of their own making, by misconceiving elections as deterministic, instead of statistical, systems.

Social choice theory has missed the point by the trivial criticism of the lack of an impossible perfection in elections, instead of acknowledging the impossibility of voters holding perfect information, which means that elections must be a probabilistic statistic rather than a deterministic deduction.

Imperfection is not a conclusion about election method, it is a premise, on which it is founded.

Voters must act on imperfect information. And their choices must be probabilities. An election is a statistical summation with margins of error. Election method is improved by marginalising the errors. The statistical technique for this is averaging. FAB STV employs a variety, of four suitably representative averages, for the shifting distributions of the voting data, during the counting procedure.

Academic anarchism has caused immense mischief to the improvement of election methods. The tree is known by its fruits. In Canada, the Ontario government corraled electoral experts, and trumpeted their pronouncement that there is no right and wrong in voting methods, leaving its Citizens Assembly to choosing a voting system, like choosing from a make of car. They even put up a picture page of different cars, just to get the message thru! A committee of

provincial politicians had already recommended the MMP system, as a pilot for the Ontario Citizens Assembly.

The axiomatic school neglects voting methods as axiomatic systems.

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Post-war election science has failed to do the proper job of axiomatic theorists, which is to develop general theory of choice. This was laid down, in its essentials, order (in the vote) and proportion (in the count), over one and a half centuries ago, by the mathematician Carl Andrae, as well as Thomas Hare.

Contemporary discussion of election methods, whether in academic theory or by its imitators in practical politics, is plagued by criteria-dabblers. So-called electoral reformers fancy this rule or that, which might suit their purposes, conveniently forgetting that to elect means to choose out, and elections therefore must follow the logic of choice.

The logic of choice does form an axiomatic system, a scientific theory of elections, which has application in effective voting method (namely a transferable voting system).

Social choice theory or the axiomatic school in general does not tackle election method, in this direct manner. Rather, it sets-up a sort of meta-method, like the Impossibility theorem, that cannot conduct an election in itself, but can only criticise existing methods or dreamt-up methods, according to its (questionable) criteria. It reminds of the Shavian proverb: Those who can't, teach.

This critique, based on an unattainable principle of democracy, compares to electoral reformers who campaign only on the principle

of proportional representation, without deigning to come down to an actual method to fight fairly against FPTP.

So, another failing of social choice theory is that it doesn't criticise the logic of election methods themselves as axiomatic systems. In this respect, that propaganda favorite, the Mixed(-up) Member Proportional system is a hybrid of self-contradictory voting methods.

I received rudely dismissive abuse, when I exposed abuses of MMP, with regard to philosophy of science.

Here is an idea of rules against Bad Science, such as the Mixed Member Proportional system (Simple plurality count plus party-proportional count).

Rule 1. Make your election test decisive and unambiguous.

A single member election (the FPTP part of MMP) is ambiguous: an X-vote, for one representative, might be for individual or party. The choice might be for either or both - or for neither: an x-vote might not be cast as a positive choice for individual or party -- rather, a strategic vote against some least liked candidate: any port in a storm.

So, the x-vote can be completely ambiguous. Since single preference spot voting can mean anything, it proves nothing, and is so far worthless to knowledge or science.

Rule 2. Theories should not presume what they are supposed to prove. The second MMP X-vote, for a party, makes the vote partisan. By 1899, Ostrogorski observed that party now chose who went into politics. Under a party-proportional count, party-owned votes are presumed a blank check to party-owned candidates.

Rule 3. Found a theory on evident first principles. MMP is based on two main principles: party proportionality (by party seats in proportion

to party votes) and local representation (by single-member districts). The partisan nature of party-proportional elections amounts to circular evidence, and a self-fulfilling prophecy, because the party vote over-rides individual choice.

Single member districts are a non sequitur of local representation, because locality is regulated mainly by the levels of government, rather than the number of seats in the constituency. Minimising voter choice, by single-member monopolies, illogically supersedes elections as locations, for place-holders, rather than freely chosen representatives.

Rule 4. Avoid inconsistent axioms for a consequential theory. Not only are the MMP axioms poorly applied, in terms of logic and evidence, but pull against each other, to their mutual confounding.

The simple plurality count, for single members, is confounded by the party-proportional count. Under dual candidature, “zombie candidates,” who failed to win First Past The Post, rise from the dead, as party list candidates.

FPTP gets its revenge, on party proportionality, when parties, over-represented FPTP, double claim on representation, with “fake” or “decoy” parties.

Indeed, legitimate parties are tempted to out-bid rivals, as coalition partners, by greater sacrifices of their election aims. In contrast, some intransigent small party might hold the keys to office for a large party and so blackmail coalition concessions.

Either scenario could be avoided by democratic arbitration of coalitions thru party-transcending transferable voting.

MMP is not so much an election as two conflicting ways of avoiding elections. The FPTP x-vote is not so much an election, as an exclusion, by way of a location for place-holders in exclusive single-

member monopolies. The party list x-vote is less an election, in excluding all social groups but parties, than a partition, for proportionally sharing the spoils between safe party men.

Nearly all MMP systems use closed lists, with no personal choice whatsoever. A Regional List was shot down in flames, in the UK Parliament, when the Home Secretary, Merlyn Rees, had to admit under questioning that his proposed open list could “elect” a party candidate with no personal votes. Party lists, open or closed, it is party before person and indeed party before country.

In the House of Commons, the former Spitfire pilot, Richard Wood MP, got up on his tin legs, to lightly remark, that he did not know the Home Secretary was a follower of Machiavelli. He called "an insult to the intelligence of the British people" that the Labour government refused voters an ordered choice 1,2,3, etc, to offer only an illiterate x-vote, first past the post, on a so-called Open list, for mere party proportional representation.

The quota-preferential (STV) system, in due course, was given to Ulster alone, in the UK Euro-elections.

Against the Mixed Member Proportional system (MMP).

1) Doubly safe seat dual candidature, by Additional Member System (AMS aka MMP), denies voters the fundamental democratic right to reject candidates. (Richard report on Welsh assembly, recommending change to STV. The McAllister report has seconded this recommendation.)

2) Double claim on representation, by parties already over-represented FPTP, using “fake” or “decoy” parties. This may be the reason why other countries, besides Italy, abandoned MMP.

3) Despite their brand name, "Open lists" are ineffective. A proposed Finnish style open list, for UK Euro-elections, could elect a party candidate with no personal votes.

The Regional List also only would elect the candidates First Past The Post on the party list. So, more popular candidates, say, on one wing of the party might have their vote split and lose to a less popular candidate, say, on the less popular wing.

The exposure of the fraud of so-called Open lists was no doubt why UK Labour always imposed closed lists, when it eventually got back into power.

New Zealand government broke its promise to use open lists for MMP.

In Brazil, 2014, open lists allowed the voters to affect the election of only 35 out of 513 deputies.

"Any electoral system would be better than the existing one, whatever it is," said Rodrigo Maia, the Speaker of the lower house of congress

This parodies English-speaking electoral reformers, desperate for open lists, to vanquish FPTP, at any cost to voters rights of effective choice.

4) Tactical or strategic voting, in party-proportional elections (as well as single member systems). "Strategic sequencing": strategic voting for a less liked party, to prevent a least liked party, from being first past the post with the biggest proportion of seats, and first chance to form a government.

Another kind of strategic voting, in party list systems and MMP hybrids, is "threshold insurance voting" for a coalition partner in danger of sinking below the threshold for acquiring seats.

I call it HILDAS vote: Help I Lane Dog Across Stile vote.

5) Split voting, in party proportional elections, can cause wasted votes. A pro-environmental vote split between the German Greens and FDP could sink either below the threshold. This in turn can cause strategic voting for the less liked but less likely party to sink.

6) Threshold Caprice. An insignificant reduction in the FDP vote below the 5% threshold lost them all 40 seats.

7) Government formation rigging. Changing threshold levels, or the ratio of single members to list members, can determine which small parties are given seats, and how many, and therefore which large party forms a government coalition.

Diminishing the share of seats for list members, in Japan, drastically reduced the number of communist seats.

8) Non-transferable voting leaves voters unable to indicate a preferred coalition. No party list system, or MMP hybrid using only X-votes, can prefer candidates of more than one party to decide which parties form the preferred coalition. The two X-votes of MMP are not an order of preference, and so are ambiguous, or deceptive, as to their true meaning.

9) Anomalies of (single X-vote) best losers MMP swiftly refuted the 1976 Blake report, in the UK. (ERS journal, Representation, Robert Newland; Vernon Bogdanor, The People and the Party system.)

10) Non-transferable voting “slavery to party managers” (HG Wells). A party vote is owned by the party, moving from one party candidate to another, in a party-proportional count, regardless of the voters wishes. (Enid Lakeman, How Democracies Vote.) Likewise, the party candidate is owned by the party whipping system.

The Mixed Member Proportional system is a dead end for democracy and indeed for an understanding of scientific method.

That concludes a brief example of the academic failure to criticise voting methods themselves as axiomatic systems.

I already discussed another failing of social choice theory, that judges election results by standards of correct deduction, instead of as a statistic, to be representatively measured.

Social choice theory presumes there is some certain answer to the voters choice, which election methods, in their imperfection, must fail to reveal. This presumption is not science but metaphysics, as it is impossible to prove. Voting returns form a statistical distribution, whose results are assessed as probabilities, rather than certainties.

The past half-century or more has seen the supposedly scientific debunking, by mathematical logic, of democratic electoral method. Social choice theory Impossibilism has been a self-fulfilling prophecy. Where is their standard model of election method?

Ultimately, the way to refute electoral anarchism is to produce a general voting method, that is immune from the current crop of mote-in-your-eye criticisms of the single transferable vote. The Electoral Reform Society called STV "the best system", on its centenary: 1884-1984.

The most advanced version of STV, in both official and expert use, is Meek method STV. It is built on well over a century of progressive evolution to that distinctive system. No other election method can claim this, nor has had such dedicated and distinguished support on the way.

Like all other official elections in the world, Meek method had the residual problem of "premature exclusion" of candidates. FAB STV avoids this short-coming.

Before considering further progress in voting method, it is well worth re-learning lessons from the early radicals, neglected by post-war academe.

John Stuart Mill identity

of Proportioal Representation with “Personal Representation”

from "Mr Hare's system."
(Representative Government. 1861).

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On the intellectual as activist.

John Stuart Mill, greatest philosopher of science, in the 19th century, was author of “System of Logic,” standard university text for fifty years.

He taught his younger siblings. A sister said he took us very far. We could have taken the Cambridge mathematics tripos examination. (Leonard Courtney took this with distinction.) Mill left half his legacy to pay for the university education of women.

John Stuart Mill said he was standing for Parliament without offering payments for campaigning expenses. Tho, he did donate to working class candidacies. He also said he would do no constituency work for any of his electorate. His sole purpose, for standing, was the two causes of legal equality for women, including the suffrage, and proportional representation.

One reaction to this unpromising announcement was that the Lord Almighty Himself could not get into Parliament on such a platform.

At a meeting in the mainly working class constituency of Westminster, the prospective candidate was asked if he had said that the working class were "generally liars." He admitted it. And Mill

Autobiography names the man who responded, that they wanted friends not flatterers.

In that life story, he recalled his editorship of the Westminster Gazette, the voice of the philosophical radicals, considering that his advocacy of a democratic constitution for Canada, to be about the only effective piece he had written.

Mill said that rather than obey a tyrannical Hell-fire God, "to Hell I will go."

When Mill entered Parliament, a crowd of supporters bore placards, reading "To Hell I will go."

Inside parliament, Mill was asked to defend a former statement that the Tories are "the stupid party." He responded, that of course he would. (It's in Hansard.)

Mill moved the first parliamentary bill for proportional representation, in 1867. Thomas Hare advocated the option for voters to order their choices for national, as well as local candidates.

This is strictly logical, if there is to be a democratic symmetry of power between government and governed. By this, is meant, that Members of Parliament can legislate for the whole nation, affecting everyone in it, so the whole nation should have a say, if desired, in electing representatives from the whole nation, and not merely from their localities.

In parliament, Mill was very much with the boldness of the Hare plan. But he was flexible on the vote having a less than national range. He was generally open to suggestions for improvement to such a novel scheme. This is over-looked by superficial and dismissive critics.

I dwell on this issue of local versus national representation, in national elections, because it typifies how little reason has to do with

human reactions.

The subsequent history of electoral reform has revealed what is behind the goat-like rebuttal of the Hare system. Over the decades, proposals for the single transferable vote have tended to decrease the size of the constituencies, in the hope of making electoral reform more acceptable to the law-makers.

On behalf of the Proportional Representation Society, Leonard Courtney proposed twelve regional STV constituencies to the 1909 Royal Commission on electoral systems. HG Wells, who was on the board of the PRS, from 1908, had no problem with this.

After the Great War, a further House taming of STV bills, proposed three to seven members. Wells opined that was much too small. But, it is apparent from JFS Ross, in his great book, *Elections and Electors*, that he is trying to distance himself from Hare system radicalism, portraying the 3 to 7 member model as modern. Tho, "modern" was perhaps thirty years old, even in the mid fifties.

There is no reason why eventually we couldn't have both options: at-large borough and shire constituencies with the option to transfer votes to outside candidates.

By 1990, another 35 years on from Ross, it is apparent from the Plant report of the Labour party, what progress could be expected from such reform moderation. The preliminary report makes plain they want nothing to do with STV. At best, there would be an off-chance of their tolerating one or two member constituencies, and no more, with STV.

HG Wells had said that one or two member constituencies were essential to the political profession, as they reduced even proportional representation to a farce.

Wells would regret he remains right: politics is for farceurs.

JS Mill said that maiorocracy is a tyranny of the majority, not democracy.

A majority is only a first approximation to democracy, namely over half the votes represented in a single member constituency. The second approximation is when two-thirds of the electorate are represented in a two member constituency. This is a two-member majority over the remaining third of the voters still unrepresented. Hence, a three member constituency could give a three-member majority or three-quarters PR with the remaining quarter of the voters in the constituency unrepresented. And so on.

This arithmetic first was pointed-out by the mathematician HR Droop to Thomas Hare. They are named after their respective quotas. The Hare quota is simply votes divided by seats. The Droop quota is votes divided by one more than the number of seats.

I invented a further quota, which is the harmonic mean of these two quotas, which I called, logically enough, the Harmonic Mean quota. It is one of the four different averages that go to make-up my invention of FAB STV.

The Hare and Droop quotas are both harmonic series. Therefore, their average must be taken by their harmonic mean. It so happens that this - the Harmonic Mean quota - is votes divided by one-half more than the number of seats.

It is of course an average, like that familiar average of "two and a half children" per family. The joke, over the average family, is that no one family can be average, in its number of children.

The mirage demonstration of the John Stuart Mill identity.

I call my demonstration of the John Stuart Mill identity, the mirage demonstration.

A mirage is a scene of deceptive proximity (caused by atmospheric lensing). In the context of elections, I define a mirage as a deceptive (ap)proximation.

The idea that there is a proportional count of parties or groups is a mirage that progressively recedes the more proportional the count is made, as more parties win less seats between them.

The more proportional the count, the more particular the extra parties become. Taken to its extreme, every individual would be their own party. This is the reduction to the absurd (*reductio ad absurdum*) of party proportional counting for representative democracy.

Even a mirage has a basis in reality. Electorally, that reality is freedom of individual choice. That is the moral of the mirage. As John Stuart Mill said: "Proportional Representation" is "Personal Representation". His posthumous Autobiography explicitly accepts both terms.

Party proportional "loyalty" shifts.

Supporters, of electoral systems with party proportional counts, vary in their beliefs of how proportional the counts must be. Partisan electoral reformers become defensive about how many or few parties be represented. Party list systems, to be workable at all, must privilege, not only parties, but an oligopoly of parties with their party proportional count.

Some rules are less restrictive than others, but it is notable that partisan reformers decry critics of countries, like Italy and Israel, with a highly proportional count that allows a multiplicity of parties.

So, the party proportional count denies elections, on the basis of individual choice, and restricts multiplicity of parties for their individualistic tendencies. Arbitrary cut-offs can more or less decrease constituency sizes and increase election thresholds, in contradiction to the alleged aim of party proportionality.

To change metaphors, the party proportional count, as a way of conducting elections, is like looking thru the wrong end of a telescope.

The meaning of this metaphor of incompetence is that the party proportional count already has the voters choice made for them as partisans, but as "partisans" of different parties, depending on just how proportional the count. This demonstrates presumed partisans as the antithesis of partisanship, due to changing party loyalties with the changing proportionality of the count.

Maj Frank Britton, of the Electoral Reform Society ballot services, asked why was the German Additional Member System (AMS aka MMP) devised, to accurately share out the seats between votes for parties, only to undo the process with a 5% threshold or barrier?

Thus, party lists and their AMS hybrids are anti-personal elections, to cut choice down to a manageably few permutations of parties in coalition, because they offer no democratically decidable preferred majority coalition.

As more parties break into the German system, it has not escaped notice that Chancellor Angela Merkel has had months of difficulty, on two occasions, in forming a coalition ministry. The closest to democratic arbitration, the country gets, is that Social Democrat

party members vote, over authorising a grand coalition with the Christian Democrats.

Party proportional elections diminish individual choice.

Elections, based on a proportional count of a preference vote magnify individual choice, by electing the personally most preferred representatives. The Single Transferable Vote offers all voters a personal order of choice that can extend preferences across party divisions, to establish such degrees and kinds of national unity that can form a government. STV follows the scientific law-like condition of unity in liberty (discussed in my third book in the Democracy Science series: Science is Ethics as Electics).

Proportional representation as proportional partisanship is the illusion of our age. The former implies the latter, but not vice versa. This age of propaganda over-looks stumbling blocks of simple logic. Electoral reform movements have generally proceeded, for the past forty odd years, on the assumption that any system, with a party-proportional count will do, to replace simple plurality elections.

Yet in the UK and other English-speaking countries, for the most prominent elections, the most promoted reforms, party-proportional counts, are not allowed to replace, but only to be chaperoned by, the simple plurality system, to which party list systems are all supposed to be superior.

If party list systems are all better than FPTP, why are party lists only seriously in contention (in Britain and Canada) in combination with plurality elections? Systems of Mixed Members cling to each other, like two punch-drunks, holding each other up.

Two different restrictions of choice, by locality and by party only make themselves more ridiculous in incompatible combination. It is their last ditch stand against the tautology that elections mean to

choose-out, which process is their proper study. In this pursuit, we continue to rehabilitate the progressive school of thought.

HG Wells principle and the election referendum paradox.

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Almost incidentally to all his other accomplishments, HG Wells was a critical thinker to voting method. He is one of a valiant and distinguished group of electoral reformer/researchers. HG Wells law of electoral entropy is a culmination of the classical school of election method, in a world engulfed in conflict, within nations, as well as between nations. Wells points to the problem of democracy so clearly, that conditions for its revival are also fairly evident. Wells was a Cassandra: Democracy would be on the defensive for the coming century.

This was both a political defensive and an academic defensive. The classical school believed in “scientific method of voting,” a phrase which Wells used. But the career politicians succeeded in their ill work, as in Britain and North America, of defeating nearly any progress in effective elections. So much so, that STV/PR became a remote, alien and altogether fantastic possibility for practical politics.

On the continent of mid-19th-century Europe, Carl Andrae made the same improvement in election method, as Thomas Hare, shortly after, in England. If system Hare proved to be a sickly child, that never grew up, in most of the English-speaking world, system Andrae, as it is known in Scandinavia (but scarcely used even there) was an abortion.

After the Second World War, academic study of elections was largely a rationalisation of this status quo. They may acknowledge the founding fathers of the French Enlightenment, like Condorcet. Mid-

20th-century text-books might give John Stuart Mill a brief patronising dismissal. And HG Wells... HG Wells? What's he got to do with it?

Actually, a highly pertinent, or as others might think, impertinent, intervention. Until recently, forgotten.

The English-speaking classical school, that flourished in the nineteenth and early twentieth centuries was over-shadowed, in the second half of the twentieth century, by an academic school, associated with the name of social choice theory. It too had scientific pretensions or nothing.

However, this is a sceptical school of election methods, with its "Impossibility theorem" of consistently democratic elections. This theorem was employed, as an excuse, in the Plant report, of an in-house Labour party commission.

The election referendum paradox.

The widespread assertion that there is no such thing as right and wrong, in election methods, is a paradox. If this statement were right, it would contradict itself, and is therefore wrong. If this statement were wrong, then there is such a thing as right and wrong election methods.

Over half a century of academic apology, for the world anarchy of election methods, is a paradox.

This academic paradox complements the political paradox of electing an election system by referendum.

Without knowing the right election method, for electing an election, there is no way of knowing how to elect it. If you do know, the

election of an election is superfluous. This demonstrates the following

HG Wells principle:

"wherever the common and obvious method of giving each voter in any election a single non-transferable vote is adopted, it follows necessarily that there can be no real decision between more than two candidates, and further it follows that the affairs decided by such voting will gravitate continually into the control of two antagonized party organizations."

"Voting, like any other process, is subject to scientific treatment; there is one right method of voting which automatically destroys bilaterality, and there is a considerable variety of wrong methods amenable to manipulation and fruitful of corruption and enfeebling complications."

"The sane method of voting is known as Proportional Representation with large constituencies and the single transferable vote... The advantage of this method is not a matter of opinion, but a matter of demonstration..."

HG Wells: The Elements of Reconstruction. (1916).

Thus HG Wells principle is that: Voting method is amenable to scientific treatment, like anything else. It is not a matter of opinion but a matter of demonstration.

A combination of the two paradoxes, academic and political, states:

If there is no true election method, then no election method can truly choose an election method.

If there is a true election method, then, the truth being one, there is no choice of true election methods.

The Prince Edward Island plebiscite used a ranked ballot to choose, or rather wring-out of the voters, after about five rounds, an unranked election method, MMP.

If that justified MMP, then you could just as well say it justified the ranked ballot for turning it up. In other words, it proves nothing, other than giving another opportunity for people to believe what they want to believe. PEI made a paradox out of a plebiscite.

HG Wells law (1918): Law of electoral entropy.

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“The problem that has confronted modern democracy since its beginning has not really been the representation of organised minorities – they are very well able to look after themselves – but the protection of the unorganised masses of busily occupied, fairly intelligent men from the tricks of the specialists who work the party machines.”

HG Wells, 1918: In The Fourth Year.

Quoted by George Hallett with Clarence Hoag: Proportional Representation. The key to democracy. (1937 ed.)

The law of electoral entropy proposes that the organised few (as in parties) forestall the organisation of the many (as for government) by disorganising the electoral system.

An organised electoral system was invented in its essentials by the mathematician and statesman Carl Andrae, in the mid nineteenth century, and soon after by Thomas Hare.

The Single Transferable Vote is essentially a statement of general choice. The particular choice, the least choice, is a single preference for a single majority. STV offers a multiple preference for a multiple majority.

In other words, with an X-vote, there is just one order of preference. A ranked choice gives many orders of preference. STV is consistent in the way it generalises the count, as well as the vote. From only one majority, in a plurality count, STV allows many majorities. The

more seats, the more majorities, over one ever-shrinking minority of wasted votes. Even an STV two-member constituency gives two majorities of one-third the votes each, over a residual minority of less than one-third the voters.

The logic for STV is what sets it apart from other systems.

As becomes a general theory of choice, STV has far greater explanatory power, of much more decisive information value, than any other voting method: the STV election, in sufficiently large constituencies, for the proportional count to discern it, mirrors social diversity, as do not other systems.

Clarence Hoag and George Hallett record that, in the at-large municipal STV elections in American cities. They also observed STV elections in-built primaries, for the most preferred candidates in any given party. They observed this does away with the inefficient primaries, as first of two-stages of elections.

And government formation power is practical, by a transferable vote across party lines, for coalition preference. This superior information value of STV is the characteristic of an organised system.

STV was meant to give (Proportional) Representation of the People. JS Mill hailed it as the saving of electoral democracy.

However, the law of electoral entropy intervened. Its first and most decisive degrading or disorganising, of the Andrae and Hare system, was to neglect the preference vote from most proportional elections, leaving a mere X vote, or one-preference vote to count only for the organised few, the parties, rather than the many, or all the people.

By a century ago, during the First World War, HG Wells was already having to avoid misunderstanding, by defining the organised voting

system, as opposed to its relentless disorganising by the meanest interests.

The HG Wells formula (Many seats PR/STV).

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The HG Wells formula is proportional representation with the single transferable vote in large constituencies.

Government did not give the People "the Vote." It gave them the stub vote, a non-transferable vote of minimum information value, and left them minimally informed, as to their ignorance, in the matter.

Confining the vote to one preference, an X vote, no longer freely transferable in a proportional count, and confining the choice of candidates, to the relatively few, standing for one or few seats per constituency, are two of the most effective ways of disorganising, or decreasing the information value of an election by the general public.

Entropy roughly means the natural tendency to disorder. The basic law of entropy is the second law of thermodynamics, popularly known as the running down of the universe. Or to borrow a phrase from the Irish poet, William Butler Yeats: "Things fall apart."

In a whole system, entropy cannot be reversed. But damaging tendencies to disorder, in any specific area, can be countered by applying beneficent organising power. Thus, the relentless tendency of the organised few, to defeat the electoral organising of the many, can be reversed, by promoting a general awareness of the organised electoral system, which Australians call the quota-preferential method or STV, and organising to promote it.

Response to a (Canadian Green) friend. (Dec. 2017).

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My attention was drawn positively to a statistical table (election-modelling.ca) evaluating various election methods. My response was as follows. I have said much of it elsewhere many times (if to no avail) but it may serve as a summary argument:

Hello Brenda,

Good to hear from you. How are you? Thank you for your question.

I use statistics to make the most representative election system, not to make out what the most representative election system is!

Only last month [november 2017], I did a couple of up-grades on Binomial STV, a three-averages and a Four Averages Binomial STV (FAB STV). No kidding.

I follow the JFS Ross (Elections and Electors) way of analysing elections. Ross says that all elections have both a vote and a count. The simplest election, a binary choice, is a single preference for a single majority. (This degenerates to a relative majority, with plural counting – FPTP – of more than two candidates votes.)

The consistent generalisation of the simplest system is a multiple preference (ranked choice) for a multiple majority (over a residual minority, as given by the Droop quota). This is what Australians call the quota-preferential method.

That is basically all there is to a theory of choice or election method.

It can be indefinitely refined (as mentioned above: FAB STV) rather as classical mechanics could be indefinitely refined on the basis of Galileo and Newton laws.

The other voting systems are what I regard as inconsistencies or aberrations, like a many-preference vote and a one-majority count (variously called the alternative vote, IRV etc).

Or a one-preference vote and a many-majority count (corporate voting systems like party lists).

These inconsistent systems are so ingrained in official electoral practices, however, that it is difficult to disengage them from our habits of thought. Hence, this simulations proliferation of voting methods, like the biblical conception of immutable species, that Darwin had to over-come, to realise his theory of evolution by natural selection.

With regard to the introduction of the overview of simulated systems:

I don't know how many times I have had to repeat the fact that the BC Citizens Assembly solved the problem, amongst others, of rural-urban PR, by making it a normal distribution of from 2 to 7 member constituencies. This solution had the especial merit that it was amicably agreed by one man and one woman from every BC riding, who therefore all knew from personal experience exactly what they were talking about. (Just as you do, Brenda!)

There is no necessary relation of STV with smaller constituencies. The BC CA chose sizes suitable for the population distribution of the province.

For over 30 years, in provincial elections, Edmonton and Calgary

had 5 to 7 member STV constituencies. Winnipeg had a 10 member STV constituency.

The introductory recommendations, of “if choosing” this or “if choosing” that, are at variance with my conception of elections. Voting method is not a fashion house. As HG Wells said (The Elements of Reconstruction): Voting method is not a matter of opinion but a matter of demonstration.

As the introducer says, all simulations are based on assumptions. Unfortunately, this one, and countless others like it, are based on a wrong one, that party proportional representation is proportional representation.

Demonstrably to the contrary, Proportional Representation is Personal Representation (the John Stuart Mill identity).

This is proved by a “Mirage” demonstration. Party Proportional Representation (PPR) is a mirage of Proportional Representation (PR).

A mirage is caused by atmospheric lensing. A faraway scene appears close, by magnification, but an attempted approach only moves it further away. Likewise, a given proportional representation of parties gives way to more parties, in larger constituencies with more seats. The reductio ad absurdum is that everyone becomes their own party.

Even a mirage has a basis in reality and that reality is voters lists (of STV) rather than the mirage of party lists or corporate votes for groups.

Moreover, party proportional counts do not even achieve their restrictive practice of giving proportional representation to this one social group, the parties. PPR does not give PR within parties nor

across parties. Whereas STV, especially in larger multi-member constituencies, has in-built primaries. This is why parties hate STV so much, because it can change the personnel of parties without much changing the balance of partisan support in the country: STV undermines career politicians job security.

The UK Labour Party preliminary Plant report rejected STV because of its “intra-party competition” in Ireland. This was picked up, shortly after, by the New Zealand Royal Commission on voting systems, influencing their decision to recommend MMP. (Nick Loenen: Citizenship and Democracy.)

STV also gave cross-party PR to Fine Gail and Irish Labour, by recommending their respective supporters express later preferences for their coalition partners, thus adding about 6 seats, from mutually extended preferences. This was democratic arbitration of preferred government coalition.

Party list systems and their MMP hybrids do not even necessarily give PR between parties. That is because the one-preference X vote can split support for two parties, either of which are more preferred than a third party that gets the plurality of votes.

This means that party-proportional systems are subject to – four main kinds of – strategic voting, as is peer-reviewed. (Annika Freden is a good example of this research.)

And proportional representation as personal representation by STV proportionally represents all society, not just parties. For example, women, immigrants and specialists in the UK NHS. Whereas before 1979, the GMC elected FPTP only white male GPs.

Hope this was helpful,

Best wishes from Richard.

Submission to the Parliament of Canada Special Committee on Electoral Reform.

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Summary and Recommendation.

Mandate.

- 1) Effectiveness and legitimacy.
- 2) Engagement.
- 3) Accessibility and inclusiveness.
- 4) Integrity.
- 5) Local representation.

Strategic voting and wasted voting in party lists, MMP systems.

Summary and Recommendation.

“Voting, like any other process, is subject to scientific treatment; there is one right method of voting which automatically destroys bilaterality, and there is a considerable variety of wrong methods amenable to manipulation and fruitful of corruption and enfeebling complications. The sane method of voting is known as Proportional Representation with large constituencies and the single transferable vote... The advantage of this method is not a matter of opinion, but a matter of demonstration; it needs but an hour or so of inquiry to

convince any intelligent person of its merit and desirability and of the fatal and incurable mischiefs of any other method...”

HG Wells, 1916, The Elements Of Reconstruction.

Binary choice is the simplest election. The voters have a single preference for one candidate over the other. These single preferences sum to a single majority of one candidate over the other. The generalisation, of this special case of a single preference vote for a single majority count, is a multiple preference vote for a multiple majority count.

The so-called preference vote or ranked choice is actually a many-preference vote, in order of choice, 1, 2, 3, 4, 5, etc. This matches a many-majority count of 1, 2, 3, 4, 5, etc majorities, by the Droop quota: One member requires half the votes; two members each require one third the votes; three members each require one quarter the votes; and so on, increasing the proportional representation, with the number of members per constituency.

This consistent generalisation, from the one to the many, of both the vote and the count, uniquely makes the single transferable vote the essentially scientific theory of choice, with the greatest power of explaining the peoples wishes.

“Science is measurement.” Sciences advance with quantitative accuracy. SS Stevens (1946, On the theory of scales of measurement, Science, 103, 677-680) analysed measurement to consist of four successively more powerful scales.

Each scale uses the natural number system (1, 2, 3, 4, 5, etc) to supply four distinct kinds of quantitative information. Only STV follows all four scales of measurement.

A summary of measurement and method of elections is, in French, as a UNESCO copyright, 1981, in Peace-making Power-sharing:

<https://www.smashwords.com/books/view/542631>

This work also records the British Columbia and Ontario Citizens Assemblies, to which I submitted, explaining their differences. (The Ontario assembly chairman said they didn't have enough time to do their job.)

The French essay is more fully treated in English, in a second book, Scientific Method Of Elections:

<https://www.smashwords.com/books/view/548524>

There is a critique of electoral scepticism that was made the terms of the Ontario CA. Also included is my solution to the universal electoral malady of "premature exclusion" of candidates: Binomial STV; and my other innovation to the proportional count, the Harmonic Mean quota.

Recommendation:

STV for Canadian federal elections, bearing in mind that this system could (and should) be used for all official elections. Political elections could adopt and adapt the BC Citizens Assembly technical report specifications.

Non-political elections could readily implement computer-counted Meek method STV, mandatory for New Zealand Health Boards.

Mandate.

1) Effectiveness and legitimacy.

Ireland learned of STV over a century ago. The public resisted two attempts to remove STV in referendums, including a provision to reduce rural areas to single-member constituencies.

In 2013, the Irish Constitutional Convention over-whelmingly backed STV [against MMP] and recommended an increase in the minimum of three member constituencies to five, for greater proportional representation.

Independent British reports favored STV, from the 1916 Speakers Conference to the 1973 Kilbrandon report on the Constitution, and more recently the Kerley, Sunderland, Richard, Arbuthnott and Tyler reports, the Councillors Commission report, and the Helena Kennedy Power report.

The wavering of the Arbuthnott report, from fully endorsing STV, followed incumbent politicians out-right rejection of the Richard report.

The apparent exception, to the STV consensus of independent commissions, was the Jenkins report, which attempted an ersatz STV called Alternative Vote top-up. In The Ashdown Diaries of 1997-9, Roy Jenkins confided that “Blair wouldn’t give us Single Transferable Vote”.

The British medical profession, in 1979, appreciated the Electoral Reform Society, for giving STV proportional representation to women, immigrants and specialists. First Past The Post had monopolised the General Medical Council for white male GPs.

2) Engagement.

STV elections in Malta had, at over 90%, the highest turn-out in the European Union. STV Ulster Euro-elections had the highest turn-out

in the UK. Irish elections had extremely high turn-outs, before the largest party reduced the numbers of seats per constituency, to steal more seats.

After the 1922 Irish treaty, the pro-and anti-treaty parties sought to pre-empt Irish public opinion on the treaty, by putting forward an agreed panel of candidates for the election. FPTP in a single-member system would have prevented any other candidates prevailing against them. But STV in multi-member constituencies allowed voters to prefer or order several candidates, pro- or anti-treaty, that gave a clear democratic direction to the country. (Enid Lakeman: How Democracies Vote.)

In Ireland, the voters extend preferences to more than one party, thus democratically establishing a preferred majority government from a coalition of two or more parties, such as Fine Gail and Labour.

When the Irish Labour party split, their supporters continued to extend their preferences over the two parties, so that their representation in parliament held up, and eventually the party re-united.

STV cannot make unity or a community but it uniquely can make unity or a community electorally possible.

The Single Transferable Vote uniquely allowed the three-seat Northern Irish Euro-elections to proportionally represent the Catholic Irish nationalist minority of one-third the population. Had the Regional List been used, the nationalist vote would have split between the SDLP and Sinn Fein. These irreconcilable peace and war parties would not share the same list, losing them a combined proportion of votes, and a seat in the European Parliament. But STV allowed nationalist voters to prefer individual candidates, in

order of choice, from all nationalist parties, till the most preferred nationalist won the elective quota.

When Sinn Fein made peace with the Unionists, SDLP supporters were more willing to give their next preferences to Sinn Fein candidates.

Tasmania, reducing from seven-member to five member constituencies, threatened Green representation. But that overlooked the willingness of not primarily Green voters to extend later preferences to Green candidates.

Even in Irish three to five member constituencies, voters, recognising environmental problems, are liable to transfer later preferences to the Greens, thus helping to secure them a few seats, and even coalition.

A unique democratic advantage of STV is that transferable voting transcends party divisions to represent universal concerns and unify a nation.

In the 2007 Scottish local elections, despite just three or four member constituencies, STV ensured that 74% of voters first preferences were elected. (Lewis Baston, Electoral Reform Society pdf: Local Authority Elections in Scotland.)

Contrast the 2007 English local elections, with non-transferable voting FPTP, where the British National Party won the Abbey Green ward of Stoke on Trent with 27% votes. David Green (Our voting system's knackered) comments: "The reaction of the 73% of those whose wishes were thwarted by the system can only be imagined."

Ranked Ballots in single member constituencies (aka Alternative Vote or Instant Run-off Voting) guarantees 50% representation, but

typically only 35% to 40% of first preferences are elected. Moreover, the AV single-member constituency offers no choice of candidates from the same party, unlike in the much greater range of choice, in a large STV multi-member constituency.

FPTP might have given the Nazis a majority of seats, in 1933. However, a party list system can promote an extremely factional party. FPTP can split the votes between more popular individual candidates. But party list X-votes can split the votes for more popular parties.

Had the Weimar Republic used STV, in 1933, the Nazi party might not have been the single largest party, with the prerogative to form a government, because nasty parties are less likely to be transferred votes from supporters of other parties.

Proportional counting without preference voting (party lists, including MMP) are as ineffective, as preference voting without proportional counting (Ranked Ballots/IRV). See last section: Strategic voting and wasted voting in party lists, MMP systems.

3) Accessibility and inclusiveness.

Enid Lakeman said since 1922, in the Irish republic, invalid ballots declined from 3.08% to well under one per cent.

As the comedian, John Cleese said about STV: If you can't count up to five, then you're in trouble.

In 2007, STV was introduced into Scottish local elections, on the same day as MMP elections to the Scottish parliament.

MMP had been used before, albeit with a different format to the ballot paper. But the number of spoilt ballot papers were relatively

small with STV, compared to MMP: about two percent compared to three and a half percent.

An apologetic public enquiry was held into the confusion with MMP. Some MPs suggested that STV should be the standard election system. STV is the policy of the Scottish National Party and the Scottish Greens.

Both the Richard and Arbuthnott reports found very little Welsh or Scottish understanding of their (unscientific) MMP systems.

Regarding Inclusiveness:

"Electoral systems have the potential for influencing the selection of under represented groups. Our research confirms that the first-past-the-post system used in most English local government elections contains the least favourable combination of factors likely to achieve this (Rao et al., 2007). The system coming closest to offering the best chance of promoting under represented groups is the Single Transferable Vote (STV) proportional system which was used for the first time in the Scottish local government elections earlier this year."

Councillors Commission 2007.

(Quoted from STV Action web-site, Anthony Tuffin.)

4) Integrity.

Dr James Gilmour held that the level of distrust, between parties in Northern Ireland, required an openly recorded manual STV count.

The Richard report on Welsh Assembly elections sent an observer to the Northern Ireland Assembly STV elections. He found that it was readily understood and that all the parties agreed it is fair.

James Gilmour, who was hired by Iceland, to supervise an STV count for a constitutional body, ensured that the British Columbia Citizens Assembly STV recommendation adopted a reliable version of the manual count for transferring votes.

Recommendation:

The BC CA report would be a good basis for the use of STV in Canadian federal elections.

The virtue of that STV manual count is that interested parties, specialists and the curious could see the moving cogs to the arithmetic mechanism, which has its fascination for some.

Democracy cannot forever be left at the unspecialised level of a prehistoric gatherer society, without any division of labor, such that everyone must understand the election count, as well as the vote.

Millions use STV in non-political elections. Many British and North American universities use STV. In the UK, the London Mathematical Society, the Statistical Society and the Computer Society use Meek STV.

5) Local representation.

“a 1997 study comparing constituency activity by junior legislators in Britain and Ireland found that Irish TDs were significantly more active in their constituencies than British MPs, undermining some FPTP supporters’ claims that you cannot have proportionality without breaking the constituency link.”

(The 2016 Irish general election. PR and the local link. Chris Terry. Electoral Reform Society.)

The anti-STV British Labour party preliminary Plant report complained that Irish STV was too much beholden to local interests. (In that case, make constituencies less local with more seats, as the Irish Constitutional Convention recommended.)

The BC Citizens Assembly of 160 men and women, in pairs for each Riding, devised constituencies to fit communities, cities having proportionately more seats than sparse rural ridings. Population shifts can be met by adjusting the number of seats. With STV, boundaries can fulfill their true role by stably bounding real communities.

The single-member system requires the expensive bureaucracy of a boundary commission, always shifting constituencies to serve the balance of power between the parties, at the expense of local community identity.

Before being abolished without consultation, STV, for many years, in Winnipeg was a 10 member constituency, giving very good PR. (Academics used its election results high information content for sociological analysis.) Calgary and Edmonton were two 5 member constituencies, giving good PR.

PR by STV probably prevented Alberta from being completely without an opposition, in 1948. For, Ranked Ballots, in single-member constituencies, in the rest of Alberta, gave Social Credit all the seats, with 58% of the votes. (Enid Lakeman: How Democracies Vote.)

Whereas BC CA devised gradations of PR, in a compromise, between urban and rural representation. Gordon Gibson commended the civility of their proceedings.

Social choice theory claims there is no fair electoral system. I guess this scepticism was an ethnocentric apology for the hounding of proportional representation from some twenty American cities.

Douglas J Amy said:

"Proportional representation also encouraged fairer racial and ethnic representation. It produced the first Irish Catholics elected in Ashtabula, and the first Polish-Americans elected in Toledo. In Cincinnati, Hamilton, and Toledo, African-Americans had never been able to win city office until the coming of PR. Significantly, after these cities abandoned PR, African-Americans again found it almost impossible to get elected."

Only Cambridge Massachusetts, with its world-famous Institute of Technology, survived the rout. The state government has forbidden other local governments to use STV/PR, putting under quarantine the politics of intelligent compromise, lest it prove a catching disease!

Enid Lakeman discussed the general acknowledgment, that local government was better run during, but allegedly not because of, PR. A typically scandal-hit municipality, Cincinnati, while reformed to PR, was judged, by Fortune magazine, the best governed city in America.

That by-word for corruption, Tammany Hall, took three referendums, with the money and the media on-side, to rid New York of PR. Eventually, one-party representation bankrupted the city, having to hand over their stewardship of the public interest to private firms.

Strategic voting and wasted voting in party lists, MMP systems.

A Fair Vote Canada video showed red lines crossing out both strategic voting and wasted votes, as not present with MMP. Not so. European academics, such as Annika Freden, show “strategic sequencing” of voters fore-going a first choice for a small party because its larger coalition partner, in a party-proportional list system, must come first past the post, as the largest party, with first chance to form a coalition government.

Conversely, voters who prefer the larger party in a coalition, may vote for a second choice party, in danger of missing the threshold of votes to be given seats. In the German MMP system, Christian Democrats were obliged to think strategically, in terms of “threshold insurance voting” for their Free Democrat partners. Just failing 5% of the votes lost them 40 seats in one go.

Both large and small party supporters also have their respective wasted vote dilemmas, in party list systems. A small party supporter may fear to waste an X-vote as a first preference, on a party that may not reach the threshold.

A large party supporter may not wish to waste an X-vote on a first preference for a party, already with a clear lead over all other parties, even if that lead is not an over-all majority.

With Free Democrats, sympathetic to Green policies, if both parties split the environmental vote to just under 5% votes each, it would lose all representation.

Conversely, MMP can disportion representation, by bloating a large party already over-represented in the monopolistic FPTP single member constituencies, if its voters can give their party list X-vote to a false pretender as another party, to scoop the proportional representation for small parties. When Italian elections used MMP, Forza Italia was one such “fake party.”

The single member system naturally gerrymanders itself from population shifts. An inequity of duplicate representation also can arise accidentally: parties policies may converge, to make them effectively one party, usurping the representation of alternatives.

In this case, party domination prevails over party divisions, an artifice of the monopolistic-schismatic vacillations of the dysfunctional MMP system.

MMP is unscientific to combine two false and contradictory axioms of domination and division, in a party monopolising single member system versus a party sharing list system.

Nor do so-called Open lists give individual choice. At best, they re-locate the split voting problem, of FPTP between parties, to first past the post within parties. Even then, the X-vote, as a party vote, overrules its role as a personal vote.

The British Home Secretary, Merlyn Rees had to admit, in the House of Commons, that an individual candidate on the Regional List, a fully open list system, might be “elected” without receiving personal votes.

MMP is a doubly safe seat system of incumbents PR. If a safe seat is lost in a monopolistic single-member district, the candidate falls back on another safe place on the party list.

The Richard report condemned MMP as denying voters the fundamental democratic right to reject candidates, and recommended its replacement by STV.

The New Zealand Labour government specified that parties be recognised in electoral reform. This has no constitutional basis in a Westminster style democracy like NZ (or Canada). They recommended MMP, the PR system that parties usually Press on the

public. A first past the post referendum split the vote between several electoral reforms.

Graham Kelly, NZ High Commissioner for Canada, remarked (in Ontario CA submission) that when voters saw MMP reported slightly ahead, fearing a split vote, they all rushed “like lemmings” behind it.

Enid Lakeman (in Canada, 1979):

(Postscript, taken from Representation; Journal of Electoral Reform Society, october 1979.)

“Both are quite extraordinary documents, which I have felt obliged to criticise in letters to their authors. One would think that a Canadian body set up to consider possible alternatives to that country’s present electoral system would as a matter of course consider Canadian experience of other systems, but no; there is not even a passing reference to STV in Winnipeg, Calgary and Edmonton or the alternative vote in Alberta.....”

“Both working parties seem to have been aware that it is desirable to give fair representation to such groups as French- and English-speaking Canadians, Indians, Eskimos, etc, but completely unaware of the single transferable vote as a means of securing this. They have allowed themselves to be attracted to the West German mixed system, without taking account of the fact that it gives proportional representation only to parties. It cannot possibly enable Indians to elect Indian representatives unless they set themselves up as a separate Indian party and that is surely not to be desired.”

Advisability of the BC Citizens Assembly STV recommendation.

Richard Lung (UK): Submission to the Attorney General reporting on electoral reform to the British Columbia government. (January 2018).

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New Zealand Royal Commission on electoral reform recommended the Mixed Member Proportional system (MMP), being influenced by the UK Labour Party Plant report, objecting to “intra-party competition” in Irish elections by the single transferable vote (STV). (Nick Loenen: Citizenship and Democracy.) The preliminary Plant report noted that less threatening to incumbency was the Additional Member System (a.k.a. MMP).

The UK Labour Party rejected democratic arbitration, thru in-built primaries, that STV gives. Instead, vicious in-fighting accompanied purges by the ascendant wing, formerly new Labour, now the left.

A transferable vote offers democratic arbitration across parties, as well as within parties. Voters can prefer individual candidates, not only within parties, but of more than one party, establishing which coalition most voters prefer.

This could save months of post-election haggling by the parties to form a government.

When New Zealanders voted for electoral reform, a second referendum gave them a First Past The Post (FPTP) choice of reforms. When a poll showed MMP to be slightly in the lead, people voted strategically “like lemmings” for MMP, so as not to split the

votes between reforms having a proportional count. (Graham Kelly, NZ High Commissioner to Canada, submission to Ontario CA.)

A democratic referendum on voting methods need not produce a democratic voting method.

An election referendum is a paradox. Knowledge of how to elect an election precludes having to elect it. An election cannot be elected in ignorance of how to elect it.

Voting method is not a matter of opinion but a matter of demonstration. It is amenable to scientific treatment, like anything else. (HG Wells, 1916. The Elements of Reconstruction.)

A court requires expert witness on specialist subjects, not uninformed testimony, from no matter how many members of the general public.

Mass ignorance, of electoral reform, showed when the mass media never got beyond the false dichotomy, of either Ranked Ballots or Proportional Representation, in which the Liberal premier framed the terms of the debate.

Informing opinion was the point of the independent BC Citizens Assembly. It started in favor of MMP, the only system with organised publicity, from the NDP and Greens, who, it turned out, were hostile to STV.

The more tutelaged Ontario Citizens Assembly yet followed much the same trajectory, as the BC CA, but ended, while its decisions were still changing. We can not know what its settled recommendation would have been. Their chairman George Thompson said they didn't have enough time to do their job.

The first BC referendum observed the "contempt of court" rule, meaning that only factual information was allowed on the working of the contested electoral systems, not prejudicial party campaigning, subject to conflict of interest.

Whereas, the second BC referendum allowed a propaganda of unsubstantiated assertions. For example, a No-to-STV tv advert alarmed about huge constituencies.

But the BC CA members, from rural and urban ridings, amicably agreed on as little as a 2-member riding for the vast wilderness constituencies; a province average of four or five, and no more than seven.

Provincial elections in Edmonton and Calgary had 5 to 7 member STV constituencies for over 30 years. Winnipeg had a 10 member STV constituency.

A years special learning by the BC CA was unlearned by the general public in a 30 second tv advert.

The provincial parliament discredited the BC CA recommendation, with two 60% barriers against the referendum vote, like police road-blocks of escaping criminals. This was not in the terms of engagement, to the CA, but imposed later, without consent. This double 60% referendum requirement was unlawful breach of contract.

Moreover, Patrick Boyer QC, held that the BC government transgressed the democratic constitution of Canada, which would have allowed Québec to leave the Federation, on over 50% of referendum votes.

Political contestants cannot be their own referees. Sport testifies to human frailty, as competition results require judgment independent from the contestants. All credit to politicians, who recognised this reality, by establishing the BC CA, under such free and fruitful conditions.

The projected third electoral reform referendum is like a match, in which the home team (the NDP-Green government) disregards the rulings of the referees (the BC CA), and appeals, for a judgment, over their heads, to the spectators (currently comprising a joint partisan majority) to out-manoeuvre the most, with the least, scientific and democratic election method.

Peace-making Power-sharing, my book, on the Citizens Assemblies, appends 1981 UNESCO article (in French): *Modèle Scientifique du Procès Electoral*.

An expanded version is the eponymous chapter of my second electoral e-book:

Scientific Method Of Elections. (STV follows four main scales of scientific measurement.)

The Spanish-speaking world has come out with the first World Electoral Freedom Index 2018:

“In fact, only Ireland, which leads the 2018 ranking, reached an outstanding level of electoral freedom, slightly exceeding the 80 points out of a maximum possible 100. Among other virtues, Ireland is one of the few countries with a single transferable vote system,..”

The 1979 audit of the Electoral Reform Society records the gratitude of the British medical profession for replacing the FPTP election of

all white male GPs to the GMC, with STV proportionally representing women, immigrants, and specialists.

November 2017 report on the Welsh Assembly recommends changing from AMS (a.k.a. MMP) to STV. So did the Richard report, because the doubly safe seat MMP system of dual candidature denies voters the fundamental democratic right to reject candidates.

The first convener of the Scottish parliament, David Steel, in his Edinburgh library speech, criticised the “democratic deficit” of AMS and urged change to STV.

In 2017, a former Scottish First Minister Henry McLeish thought all MPs should be elected on a proportional basis, and former FM Jack McConnell criticised the party lists half of the hybrid system, in giving jobs for life.

Postscript: In february 2018, Andre Carrel of the Terrace Standard drew attention to some points, my detailed "Peace-making Power-sharing" account missed, about the 2005 and 2009 BC referendums on STV:

"The May 17, 2005, electoral reform referendum asked:

Should British Columbia change to the BC-STV electoral system as recommended by the Citizens' Assembly on Electoral Reform?

A majority (981,419 – 57.69 per cent) voted yes but it fell short of the referendum's approval conditions. A second referendum was held on May 12, 2009. The essence of the question was identical to the 2005 question, but the wording and presentation were profoundly changed:

Which electoral system should British Columbia use to elect members to the provincial Legislative Assembly?

The existing electoral system (First-Past-the Post).

The single transferable vote electoral system (BC-STV) proposed by the Citizens' Assembly on Electoral Reform.

The majority (971,353 – 60.91 percent) voted for the First-Past-the-Post system.

Not only the wording and presentation were changed for the 2009 vote, so was the voting process. The 2005 referendum used polling stations; the 2009 referendum used mail-in ballots. A March 2009 Angus Reid Poll showed a 65 percent support for BC-STV, but it also showed that a mere 44 percent were aware of the pending referendum. More citizens voted to adopt a new voting system in 2005 than voted to retain the existing one in 2009!"

Electoral Reform.

Submission to the Scottish government consultation paper, 2018.

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Life is short, and five-year terms seem a long time since we last voted for a particular parliament. The public don't owe politicians a living. There should be a democratic infrastructure, a public information platform that gives a level playing field for any citizens who want to campaign for election.

Infrequent election cycles also highlight the importance of having effective voting, when we get to use it!

“Effective voting” was the name given, by Scottish born Australian reform pioneer, Catherine Helen Spence, for the Single Transferable Vote. The use of STV in local elections means that electoral officials are well placed, should Scotland decide to make this the nations standard system, as in Ireland.

The 2013 Irish Constitutional Convention, over-whelmingly endorsing STV over MMP (aka AMS), further recommending a minimum of five member constituencies.

The draft Scottish Constitution recommends a minimum of four seats per constituency, elected by the single transferable vote. The latter also was proposed by The report of the Expert Panel on Assembly Electoral Reform. November 2017: A Parliament That Works For Wales. Their reason was that studies show representing social diversity requires this minimum numbers of seats per constituency.

This confirms what common sense would lead to believe, namely that monopolies and oligopolies in seats per constituency would be reflected in the representation. Hence, the incentive for incumbent special pleading over single members or small constituencies.

Another important consideration is that constituency boundaries follow community boundaries. As Winston Churchill said: I would rather be one fifth of the Members for the whole of Leeds, than one Member for a fifth of Leeds. (*Joe Rogalay: Parliament For The People.*)

However, the proportions of populations to communities “normally” follow a normal distribution. Hence, the British Columbia Citizens Assembly recommendation of STV was based on a 2 to 7 member range, about an average of 4 to 5, amicably agreed between the rural and urban riding members (one man and one woman from each riding). This, in a vast wilderness province considerably larger than Germany.

The single-member system of continual fragmentation is disorientating, and defeats the purpose of boundaries for constituents to identify with stable communities. Familiar surroundings are of psychological importance for personal orientation. Population changes could be addressed by proportional changes in the number of seats in the constituency.

Large constituencies are necessary but not sufficient means of representing social diversity. In particular, at-large elections, with STV can approach mirror representation, as of the NHS, where STV elections to the GMC, proportionally represent women, immigrants and specialists. Whereas before 1979, FPTP represented only white male GPs.

"Cambridge, Massachusetts has used ranked choice voting to elect its nine-member city council since 1941. Cambridge locals and academics have praised the system for ensuring full representation of Cambridge citizens and maintaining proportional representation for women and racial minorities, even during periods of elevated tensions elsewhere."

Fair Vote (USA).

The 2016 STV election, to the Australian Capital Territory Legislature, proportionally represented women, as well as the parties.

"The system coming closest to offering the best chance of promoting under represented groups is the Single Transferable Vote (STV) proportional system..."

Councillors Commission 2007.

(Quoted from STV Action web-site, Anthony Tuffin.)

Even the Labour Party Plant Commission, for an anything-but-STV policy, admitted in its preliminary report, that STV elections best represent social diversity. The document merely asked whether there isn't some other way to do it!

The report disliked STV "intraparty competition" [a camouflage phrase for its in-built primaries] in Irish elections. Saying for AMS (p. 89):

"...it would threaten the vested interests of sitting members much less than would any other alternative."

Both before and after Plant, this career politics has done immense mischief to the progress of electoral democracy. Shortly after, the

New Zealand Royal Commission on electoral systems picked up on this Plant report motivation, to recommend AMS (aka MMP). (Nick Loenen: Citizenship and Democracy.)

Reported in a Times article by Simon Jenkins, when the North-East and Yorkshire voted against regional assemblies, John Prescott simply appointed the regional bodies en masse – from which process, going thru the motions, of an election with AMS, would have differed very little.

The Richard report counted what little difference AMS "elections" made in Wales. The Richard report, on the Welsh Assembly elections, and the McAllister report, for a Welsh Parliament, both have recommended replacing AMS with STV.

Labour has promoted dud voting systems in Britain, with AMS, as well as the Supplementary Vote and Closed Party Lists, thus encouraging its proliferation in other English-speaking countries, and thereby degrading the prospects for the public interest in a democratic world.

Labour plastered or tried to plaster AMS on every nation or region in Britain, ignoring their own Royal Commission on the Constitution, the Kilbrandon report, that unanimously recommended STV. The Labour party Scottish executive could not be prevailed-upon for STV in the Scottish Parliament.

An SNP MSP rightly praised the Labour-Lib Dem coalition, introducing (albeit a four seat constituency maximum) STV in local elections. Even that went against the vote of the Scottish Labour party.

HG Wells (a Labour candidate) said Labour was as bad as all the parties for voting method opportunism – “or worse.” (A Year Of

Prophecy.) The HG Wells formula is proportional representation with the single transferable vote in large constituencies.

Visionary reports, like those chaired by Kerley and Sunderland, have offered a New Deal between government and public, allowing, with STV, many voters (like myself) to actually elect someone, during their life-times, and allowing representatives to train for vocational qualifications, lest they not be re-elected.

With regard to internet voting, I believe expert advice cannot guarantee it secure.

The Consultation Paper makes a compelling case for electronic voting.

As far as I know, electronic counting of STV, in Scotland (unlike New Zealand), does not use Meek method, which is marginally more consistent than the traditional count. Dr David Hill, writing in Voting Matters, was concerned Scotland did not adopt Meek method for electronic counting, in the first place.

If it could be done, without much trouble and expense, then I would recommend change to Meek method. Otherwise, there is little if any practical gain.

The main potential gain from Meek method is the new concept of the “keep value” in an STV count. I have an interest to declare, having extended the use of this measure to make possible more representative results by statistical averages of recounts. Namely, FAB STV: Four Averages Binomial Single Transferable Vote. This is the title of my new fourth, most technical book on electoral reform and research. Tho, the first part is for the general reader.

I mention my radical development of STV, not to supersede existing practise, especially as comparative data remains valuable, but to promote existing STV usage, precisely because it does point the way to the future of electoral knowledge.

My new method will take a lot of development, and years of testing, before ever coming into familiar use, which I don't count on seeing. (Brian Meek never saw his method officially employed.)

Australian use of STV: from Geoffrey H Powell

(lifetime member of the PRSA [Proportional Representation Society of Australia.])

In the 2009 BC referendum on STV, habitually fact-deficient opponents, betraying their mediocrity, fostered the impression that STV was a lunatic fringe idea, by saying STV is used to elect just the national parliaments of two little islands, Ireland and Malta. They were apt to forget that other "little island," Australia. Not to mention the few million using STV in professional elections, where party privilege cannot obtrude, as it generally does in political elections.

The following is with thanks to Geoff, who I asked to outline the main political uses of STV in Australia.

STV is used in half state and federal elections in Australia. We handle it better in the Senate now that group voting tickets have been abolished and voters no longer have to number all candidates.

The [one-chamber] Australian Capital Territory Legislative Assembly has members elected from three 5-member Hare-Clark STV districts. Learn how from their electoral commission.

Tasmania is the reverse of mainland states in that the lower house is elected by Hare-Clark STV in 5-member districts and the upper house by AV in single-member districts. Neither house has above the line voting for parties.

The mainland states and [one-chamber] Northern Territory use AV (ranked ballot in single-member districts) for the lower houses with

all but New South Wales insisting on preferences being cast for every candidate. The upper houses all use STV with NSW and South Australia state-wide with overlapping terms. Western Australia and Victoria use multi-member electorates and it is Victoria that uses above and below the line voting. Below the line voters are not required to number all candidates; 5 or more preferences is valid. Victoria copied the infamous Group Voting Tickets from the senate when PR was introduced in the 1990s. Now that GVTs are dropped from the senate there is a push to do the same in Victoria and introduce Robson rotation of candidate names.

Dropping GVTs was a step forward in the senate. Abolishing regimented voting for parties is next step.

[Geoff Powell on the Alternative Vote, alias IRV, Instant Run-off Voting.]

Major parties in Australia love IRV. Because they can get away with nominating only one candidate per district, 70% of seats are safe for one side or the other. The other marginal seats are rarely won by minor parties or independents. Psephologists have even invented the fiction of TPP (Two Party Preferred) which ignores the wishes of voters like you and me who want nothing to do with either of them.

Some worthwhile reports on the effect of recent senate reform:

[the conversation .com/profiles/stephen-morey-92391/articles](http://theconversation.com/profiles/stephen-morey-92391/articles)

[kevinbonham .blogspot.com.au/](http://kevinbonham.blogspot.com.au/)

Another Australian, Malcolm Baalman details both Australian and other countries ways of electing paliaments. His blog is <https://onelections.net/>

Part two.

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Over-view of Four Averages Binomial STV (FAB STV).

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The most advanced voting method in the world is Meek method STV. This particular version of computer-counted STV has been adopted by expert bodies in mathematics, statistics and computers, after being tested by specialists, including the late Dr David Hill - descended from Thomas Wright Hill. 2021 is his bicentenary for originating proportional representation by transferable voting.

For the first time, on the planet, Meek method was adopted for political elections, voluntarily by some local councils in New Zealand (largely thanks to the good offices of Stephen Todd and the late Green party co-leader Rod Donald MP).

Brian Meek first published his computer count method in the late 1960s (in French, as reported in the Electoral Reform Society journal, Representation).

STV in general follows the John Stuart Mill identity of Proportional Representation as Personal Representation. (This is proved by what I called the “Mirage” demonstration.)

Meek method did not merely computerise traditional STV procedure. It introduced an algorithm based on the key concept of the keep value. (You could say that FAB STV took the Meek method concept of the keep value, and ran with it.) This is a ratio which measures elected candidates ensuing popularity during the stages of the STV count.

Binomial STV gives all candidates (not just those whose votes have reached the election quota) a keep value. The count stops when there are no more quota surplus votes to transfer to next preferences.

Unlike all previous STV methods, including Meek, Binomial STV does not resort to excluding a candidate with least votes at that stage.

This is criticised as the problem of “premature exclusion.” It was noticed by Condorcet, who pointed-out that excluding different candidates could result in different winners. This is known as the Condorcet paradox. The Condorcet winner occurs if a candidate wins every paired contest.

FAB STV avoids the exclusion problem, with a fully fledged exclusion count, which is a mirror image of the election count. In other words, the exclusion count is conducted, in reverse, for the most unpreferred candidates. This calculates the keep values for the candidates that voters most want excluded, rather than elected.

Inverting the exclusion keep values, in effect makes them an alternative measure of candidates election keep values. It is then possible to average (by the geometric mean) the candidates respective election and inverted exclusion keep values for a more representative final result. This is first order Binomial STV: an election count of preferences and an exclusion count of reverse preferences or un-preferences.

Binomial STV encourages bidirectional preference. The ballot paper gives the number of candidates. If there are 12 candidates, the voter can order a choice of least liked candidates: 12, 11, 10,... This might form a complete ballot order from 1 to 12. But it does not have to, to be a valid ballot return.

In all cases of Binomial STV, all the preference information is used, including abstentions. The return of a completely blank ballot paper would count as None Of The Above (NOTA) giving one whole vote towards the quota for a seat left vacant. This use of all the preference information is essential. Otherwise, the exclusion count would be weighted unduly against the election count.

Therefore, Binomial STV differs from Meek method, which reduces the quota with exhausted ballots from voters ceasing to express a preference.

Abstentions inclusion is an incentive to organisations to put-up better candidates. Moreover, voters can make not only their likes, but their dislikes and indifferences felt with Binomial STV, which is a voter participation incentive.

Binomial STV (STV[^]) differs from all previous versions of STV, in that it conducts the count for single vacancies in the same way as for multiple vacancies. Traditional STV transfers surplus votes, from most preferred candidates, already elected on a quota, to next preferred candidates, till they also reach the quota, required to take another seat, in a multi-member constituency.

STV[^] also does that. However, it expresses this in terms of keep values. Meek method only calculates elected candidates keep values. But STV[^] also calculates unelected candidates keep values. This extension of the use of keep values provides a general standard of comparison that can be used just as much to decide single vacancies as multiple vacancies.

For theorists, who seek general explanations, STV[^] fulfills the requirement of a consistent treatment of both single and multiple vacancies.

It is true that single vacancy elections are less desirable for lack of proportional representation. But STV¹ keep value representation of single members, as well as multiple members, offers them a more accurate or powerful scale of scientific measurement than previously available.

As mentioned elsewhere, technically speaking, the geometric mean (of election and exclusion keep values) achieves an interval scale of measurement, the second most powerful scale, to the ratio scale (found in the rational count, called proportional representation).

Higher orders of Binomial STV count are qualified versions of these first order counts, increasing exponentially in number, according to (a non-commutative version of) the binomial theorem.

A convenient notation for Binomial STV makes use of the fact that the binomial theorem is expressed in powers of 1, 2, 3, etc orders.

Google notation for a power is the circumflex, [^]. Therefore, I summarise the term, Binomial STV, like so: STV[^].

First order Binomial STV, just described, is given by: STV^{^1}. Second order Binomial STV is: STV^{^2}, and so on.

Even second-order Binomial STV (STV^{^2}) with four (instead of STV^{^1}, with just two) different counts can be hugely more complicated. This is because higher orders require a re-distributing, of a quota-reaching candidates votes, to the rest.

At first, I thought just the candidate with the biggest surplus vote, would serve. Later, I was inspired by the Condorcet principle of systematic re-counts. That is why I decided the fairest way was to re-distribute the votes of each quota-reaching candidate in turn, and then take the average of all the keep values for each re-distribution. The required average, in the re-distributions case, is the arithmetic mean.

Averages give the most typical or representative results. So far, two have been mentioned: the geometric mean and the arithmetic mean. It so happens that besides inventing Binomial STV, I also introduced the Harmonic Mean quota, as the average of the maximum proportional count (Hare quota) and minimum proportional count (Droop quota). The Hare and Droop quotas respectively can be too hard and too easy to fill, to give decisively democratic results.

The Droop quota allows a candidate to defeat another with only one more vote, but that is not statistically significant. On another day chance might have gone the other way. We are supposed to be measuring genuine popularity, not playing a game of chance.

Whereas, the Hare quota requires unanimity for election to a single vacancy. In most cases, this cannot be achieved without some of the voters succumbing to the instinct to conform, or obeying authority or both.

The Harmonic Mean quota escapes both extremes of being either the play-thing of chance or the puppet of deterministic forces. The HM quota offers an avenue of freedom.

This made three averages but I thought that perhaps there should be a fourth. I noticed that the averages seem to correspond to the scales of measurement, of which the sciences know four, in the main.

Yet no fourth average is associated with the arithmetic mean, harmonic mean and geometric mean. After some puzzlement, the vital clue came from considering that the geometric mean is a power (index) arithmetic mean. That is to say that in doing a geometric average, you take the arithmetic mean of powers to terms with the same base.

Then I realised that the fourth average must work by taking the harmonic mean of powers to terms with the same base.

My innovation of the power harmonic mean is slightly smaller than the smallest of the three standard averages, the harmonic mean (which may help to explain why it has been over-looked).

What is more, Binomial STV offers a possible application of the power harmonic mean, which might average the successive keep value results of first, second, third, etc order Binomial STV.

Hence, Four Averages Binomial STV (FAB STV).

Fast track explanation of FAB STV for those familiar with Meek method.

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With apologies for all the repetition, I still think it might be helpful to clarify the relation of this FAB STV monster to Meek method. First order Binomial STV (STV^1), which is the basic model, follows the Meek method of transferable voting, in both the two counts, of which STV^1 consists: an election count of preference and an exclusion count of reverse preference or unpreference.

Binomial STV, in general, (STV^n) takes from Meek method the key concept of the keep value and extends it, so that the keep values are counted of candidates with deficit values, as well as surplus values. No candidates are eliminated or excluded, at any stage, in any Binomial STV (STV^n) counting procedure.

STV¹ replaces an exclusion stage (for eliminating or permanently excluding a candidate) with an exclusion count. All the candidates exclusion keep values are inverted to create alternative election keep values. These inverted exclusion keep values are averaged with the keep values from the election count, to give the final keep values of basic binomial STV (STV¹).

The average used is the geometric mean, one of the four averages to FAB STV.

A further difference from Meek method is that all the preferences, including abstentions, have to be counted. This is a logical necessity. Abstentions actually count towards voters not wishing a seat to be filled by anyone, going towards a vacant seat quota. Voters usually abstain on their later preferences. If abstentions are not counted, during an exclusion count of reverse preferences, that, in effect, demotes the least preferred candidate to the least possible preference, unduly weighting that unpreference with portions of the vote that should go towards a quota of abstention, not a quota of unpreference.

Thus unduly weighted unpreference keep values would distort the final result, when (inverted and) averaged with the preference keep values.

It also follows that STV¹ has no Meek method reduction in the Droop quota with preference exhausted votes, because abstentions are also counted.

Moreover, STV¹ commends my other invention of the Harmonic Mean quota (for at very least four-member constituencies) as the average of the maximum (Hare) and minimum (Droop) quotas for proportional representation.

With the geometric mean, this accounts for two of the four averages to FAB STV.

The third average (the familiar arithmetic mean) only crops up in second order or higher-order Binomial STV (STV^n). All orders still completely conform to the Meek method algorithm for transferring surplus votes. But they do so, under a system of qualified re-counts, determined by (a non-commutative expansion of) the binomial theorem.

The recounts may be conducted for the re-distribution of votes from more than one quota-reaching candidate (so qualified as preferred, P, for election or unpreferred, U, for exclusion). The arithmetic mean keep values are taken of the keep values resulting, or transpiring, from each quota-reaching candidates vote re-distribution.

The two terms, P and U, are the bi- in binomial STV.

STV^1 is $(P+U) = (P+U)^1$.

STV^2 is $(P+U)(P+U) = (P+U)^2$.

STV^2 expands to four non-commutative terms because they represent four distinct counts. These are two qualified preference counts, PP and UP, and two qualified unpreference counts, PU and UU. The counts are qualified by re-distributions either of preferred candidates or unpreferred candidates, who have reached an election, or an exclusion, quota.

The binomial theorem tells the qualified counts schedule, for any order of count.

Binomial STV is a generalisation from conventional or uninomial STV or STV^0 . There is only the one count, a count of preference.

When young, I showed that transferable voting coincided with four main scales of scientific measurement. (Unesco, 1981, took a copyright on the essay, still extant in French. And the title of my booklet: *Modele Scientifique du Proces Electoral*.) I noticed that the three recognised averages seemed to correspond to the scales of measurement. But where was a fourth average to match the four scales?

The first three averages are the arithmetic mean, the harmonic mean and the geometric mean. The geometric mean may be described as a power arithmetic mean. (To find the geometric mean of power terms, with the same base, find the arithmetic mean of their powers to that common base.) That was the clue that led me to a fourth average in the set, namely a power harmonic mean.

This fourth average is the most weird and wonderful of them all. It comes into practical use when you average different orders of keep values, most basically, the average, of first order binomial STV (STV^1) final keep values, with second-order binomial STV (STV^2) final keep values.

The electoral reform debate does not understand that simplicity in the count is not a virtue. Neither is complication, for its own sake, but completion is. And that makes voting method a specialist subject, like any other science, requiring study to become competent.

Ten incentives to FAB STV.

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These ten incentives draw attention to fundamental laws or reasons for FAB STV. They are subject to the normal process of scientific progress, of which they are themselves a result. This section is a destination, because it anticipates the conclusion of this work, that could be read again at the end of the book.

Bearing in mind the stricture, of Clemenceau, on Woodrow Wilson, in making 14 points for peace, that even the good Lord only gave us ten, here are ten reasons for FAB STV, the most advanced method, in prospect, of peace-making power-sharing.

In his book, Parliament For The People, Joe Rogalay called STV the super-vote. FAB STV is the super-vote super-charged.

In order to make voting results more representative, Binomial STV (STV[^]) uses four averages, in keeping with the counting procedure which transforms the transferable vote thru different statistical distributions.

On the way, there are a good many gains from FAB STV, which are numbered one to ten.

1) The Harmonic Mean quota distances the voters choice from determinist and chance factors, in the maximum and minimum extremes of proportional count.

The first average, of the four averages, was a new quota (invented by the author) the Harmonic Mean quota (HM quota). Former quotas for proportional representation (by STV) used the Hare quota and

the Droop quota. These are, respectively the maximum and minimum quotas for proportional representation.

Both quotas form a harmonic series, in terms of number of votes, V , divided by number of seats, S (Hare quota), or number of votes, V , divided by one more than the number of seats, $S+1$, (Droop quota). Therefore, the average of the quota range from maximum to minimum PR is the harmonic mean.

To obtain, invert the two quotas, add them and divide by two. Thus:
 $\{S/V + (S+1)/V\}/2 = (2S+1)/2V$.

Invert again. Hence, the HM quota, which is votes, V , divided by one-half more than the number of seats, S :
 $V/(S+1/2)$.

The Hare quota requires all voters to defer to one representative, for an election to a single vacancy. Free choice may be sacrificed to some determination for the sake of unanimity. The Droop quota only requires half of the voters to elect to a single vacancy, which is statistically insignificant, meaning it could result in a chance win. The HM quota is the first of the Four Averages belonging to Binomial STV (STV[^]).

2) Relative level of satisfaction with the candidates.

Meek method concept of the keep value is the key that opens the doors of STV[^]. The keep value concept is extended for all candidates, so that every candidate is ranked from smallest to largest keep value each possesses.

STV[^] extends the use of the keep value for candidates in deficit of a vote, as well as a surplus. As keep value plus transfer value equals

one, and deficit keep values are greater than one, this implies a negative transfer value.

3) No chance candidate disqualifications, with a rational exclusion count, as well as election count.

The all-candidates keep value makes possible a rational exclusion count, as well as a rational election count, removing the universal malady of “premature exclusion” of candidates. All existing official election methods (including the best of them, Meek STV) are so prone, especially in single vacancy elections.

Count the preferences in reverse and thus find the exclusion keep values. Invert them and average them with the election keep values, using the geometric mean.

The GM is the second of the four averages to FAB STV.

4) Theoretical consistency of the same count for single and multiple vacancies.

The STV[^] count, by consistently applied keep values for all candidates, is as powerful a count procedure for single vacancies, as for multiple vacancies. There is no longer an artificial distinction between STV and AV, because a surplus vote is not transferable from a single vacancy.

Single seat STV[^] still has all candidates keep values to calculate and average over both election count and exclusion count.

However, single vacancies are not recommended because of their monopolistic representation excluding agreement by intelligent exchange.

5) Bidirectional preference from Binomial STV.

The bi-, in binomial, refers to the two variables of an election count of preferences and an exclusion count of unpreferences.

Binomial STV allows a Bidirectional preference vote. Voters can order their choices not only from most preferred but from least preferred. The ballot paper gives the total number of candidates, say twenty. The voter may order least liked candidates: 20, 19, 18,...

Bidirectional preference potentially gives more power to search engines, with whole orders of positive and negative choices, rather than only a single preference in both directions (plus and minus, respectively, for election and exclusion of items searched-for).

6) Over-all level of satisfaction with the candidates.

All preferences, expressed or absented, count equally. Partly exhausted ballots or Totally exhausted ballots (None of the Above) help towards a quota for an unfilled seat. A blank ballot returned is equivalent to NOTA.

The election of a vacant seat is equivalent to the election of an anonymous candidate. It follows that the voters should be allowed to offer an unofficial candidate, to render the anonymous known. A FAB STV computer program must take into account the logical possibility of all seats being unfilled. It is theoretically possible that the voters might have substitute names to offer for all the vacancies. Therefore, a FAB STV ballot paper should have as many blank spaces for possible unofficial candidates as there are spaces filled by official candidates.

Indeed, all preferences, expressed or not, have to be counted equally, in order not to give undue weight to last expressed preferences, in the reverse preference count. For, the last preferences, normally are not expressed. However, STV[^] may encourage a fuller expression of later preferences, on average, helping to count against most disliked candidates.

Also, this means that STV[^] differs from Meek STV, which reduces the quota as ballots become exhausted or express no further preference.

7) Higher orders of counts refine the search for most representative candidates (or most representative data retrieval).

Combining an election count with an exclusion count, is a first order count. Following (non-commutative) expansion of the binomial theorem, second, third, fourth etc order STV[^] elections are possible.

Higher order counts are systematic recounts, redistributing the votes of all candidates reaching a quota of election or exclusion. The resulting qualified keep values from each recount are then averaged with the arithmetic mean, the third average of FAB STV.

8) Each higher order count result may itself be averaged by a fourth average (introduced by the author) the power harmonic mean.

Unlike the geometric mean, which would average each order count equally, the power harmonic mean gives a very slight weight to the more refined higher order result compared to the lower order result. Therefore the power harmonic mean may be deemed the more representative average of orders of STV.

The power harmonic series is of fractions that diminish exponentially. This pattern is obtainable from the expansion of the binomial theorem, if one of its two terms is reduced from unity to a fraction. The two STV[^] terms are P (for Preference count) and U (for Unpreference count). Given that P is set at unit value, then U could be at a fraction.

This is justifiable, because normally voters abstain from stating last or later preferences. Therefore Unpreferences will not have the same weight as Preferences, because of the attrition from exhausted ballots.

Even if use is made of bidirectional preference, the ranking of those the voters dislike will probaably be less thoro, than the ranking of liked candidates.

The fourth average may complete a correspondence to the recognised four main scales of scientific measurement (given by SS Stevens).

9) Binomial STV and beyond, for data mining.

In general, statistical analysis of the vote may be indefinitely refined.

Nor does it have to stop at the binomial theorem! Once Binomial STV dimensionalises the vote, the scope for dimensional analysis is only limited by the imagination and power of computation, multinomial, or complex multinomial or hyper-dimensional. Whatever!

This possibility may be of practical importance for searching the exponential growth of human knowledge, in the science of data mining or data retrieval.

10) or (0) FAB STV shows the way for the scientific evolution of voting method. The stub vote or non-transferable vote is pitifully limited. The transferable vote is the way to go. Therefore, existing methods of transferable voting (STV⁰) should be fostered as a basis for progress, and for their value in their own right, in data comparisons with FAB STV, which will take long and intensive study to deploy.

Statistics of the scales of measurement

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My early studies related the logic of the single transferable vote to the scales of measurement. This is explained in the eponymous chapter of my book, Scientific Method Of Elections.

It is said that science is measurement. I showed that the logic of choice could likewise be measured. Knowledge and freedom are like two sides of the same coin. They depend on each other and enhance and promote each other. This led to a further book, Science Is Ethics As Electics.

The four scales of measurement.

SS Stevens identified four main scales of measurement. The first scale is classification or the nominal scale. One person, one vote is such a classification. Nominally, everyone has the vote. But that vote may not elect anyone, in which case, it is a vote in name only, and not much good.

Moving onto the second scale of measurement, the ordinal scale, your vote becomes an order of choice, making more likely that the voter will prefer some candidate to another. This is what Thomas Hare called a contingent vote.

An ordered vote was found to have its limitations in the count, because the winner of an election depended on which candidate was

first eliminated from the contest. This is known, after its discoverer, as the Condorcet paradox.

The Condorcet method known as Condorcet pairing is to pair all the candidates, in binary or straight contests, and find out thereby who wins them all, and is therefore the Condorcet winner. Or failing that, who is the majority winner, of most of the contests, if there is one.

The Chevalier de Borda answered this paradox by weighting the preferences in order of importance. He recommended an arithmetic series.

This is a standard technique in statistics, known as weighting in arithmetic progression.

JFS Ross thought the arithmetic series gave too much weight to later preferences, and recommended instead a geometric series. A compromise between the two is weighting with the harmonic series.

Pierre Simon Laplace set out to prove whether Condorcet or Borda were right. He decided in favor of the latter, because later preferences are less important than earlier ones.

Statisticians use weighting in arithmetic progression, on a distribution of data, in order to arrive at a more realistic assessment of its average or representative value. This is done as an informed guess, when they don't know the exact weights of each interval, into which items, in a range of data, are conveniently grouped.

When the relative weights of the intervals of data are known, then these are used to give a more accurate average. Statisticians call this weighting in arithmetic proportion.

This is the same technique, invented by JB Gregory, to transfer the surplus votes, from the quota needed to elect a candidate, by

proportionately considering all his voters next preferences.

This weighting of intervals, on the scale of measurement, is known as the interval scale of measurement, the third of four main scales.

The fourth scale is the ratio scale of measurement. It is the quota of votes to elect a candidate. In multi-member constituencies, the quotas are in proportion and give a measure of proportional representation.

It is thanks to my education in statistics, on a social science course, that I owe this understanding, pursued in my solitary twenties and thirties.

Four scales: four averages.

In old-age, I can now complement work, begun in my young adulthood. I observed the makings of an apparent correspondence between the scales of measurement and statistical averages. This has taken a bit of puzzling out. As far as I can gauge, a statistical perspective is more conveniently approached in reverse to the usual consideration of the four scales, as they increase in power and accuracy.

The usual approach to measurement, that I gave above, was an individual approach. It was the point of view of individual voters. There was a measured modification of their votes and a measured modification of how those votes were counted.

Ratio scale: harmonic mean.

In contrast, statistical averages offer a collective approach. The fourth and most powerful scale, the ratio scale collects proportions of voters. The Harmonic Mean quota averages for the most representative way to proportionally elect representatives. The HM quota averages the maximum (Hare) and minimum (Droop) quotas, which both form harmonic series.

Interval scale: geometric mean.

Moving in reverse to the third and next most powerful measurement scale, the interval scale was represented by Gregory method. Meek method translates this into the keep value, which is the ratio, of the quota, divided by a candidates votes.

Candidates can have keep values, in both an election count and an exclusion count. The keep values of these two counts can be averaged by the geometric mean.

This is the average, suitable for representing a geometric series, such as is described by the ever more rapid falling off of the weight from surplus votes in successive transfers of voters preferences.

The geometric mean cannot average, with an item valued at zero, which would result in a zero geometric mean. This is the deficiency that distinguishes the interval scale from the ratio scale, which has a true zero.

Ordinal scale: power harmonic mean.

Still moving in reverse, on the scales of measurement, next is the ordinal scale. Linking this to a statistical average was the most puzzling problem. Binomial STV refers to there being higher-order counts than the basic first order counting procedure, which consists

of a simple election count of preference, P , and an exclusion count of reverse preference or unpreference, U .

With second and higher order binomial STV, it is the orders of P and U terms, of the non-commutative expansions of the binomial theorem, that determines the system of qualified recounts.

So, it is fair to say that - after a fashion - an ordinal scale is at work here.

There is also another average, that comes into play, when averaging the candidates keep values, as determined by different orders of Binomial STV.

Most voters abstain from filling in all their preferences. Graphs of this show voters diligence falling off exponentially. We must be careful here, because Binomial STV has bidirectional preference, so the pattern of voting should change. On the whole, one would still expect less expression of Unpreference than Preference. After all, the primary purpose of an election is to prefer, not unprefer, people for office.

The difference between preference and unpreference is the weight of votes for abstentions, which would go towards a quota that would leave a seat vacant.

If preference be set at a standard of unity, then unpreference may weigh at a fraction less than unity. When the two terms in the binomial theorem are set at those values, then the expansion forms a power harmonic series. That is to say the fractional terms denominators do not decline arithmetically, like a harmonic series, but they decline geometrically, which is to say as a power harmonic series. Each successive term contains expressions like: $1/x$, $1/x^2$, $1/x^3$, $1/x^4$, etc.

Given that orders of Binomial STV are essentially of that pattern, then the suitable way, to average them, would be with a power harmonic mean.

(This is explained and calculated in later chapters.)

Classifying scale: arithmetic mean.

Usually, mention of averages assumes the arithmetic mean, which we haven't mentioned yet. It may be related to the fourth of the scales, taken in reverse order, namely classification. The arithmetic mean simply takes any class of uniform objects, like the number of votes scored by different candidates, and divides by the number of candidates, to obtain the average number of votes, that a candidate can be expected to score.

However, the arithmetic mean also occurs, in the much more complex situation of second or higher orders of binomial STV.

For example, in second-order STV (STV^2) the binomial expansion for deciding this system of qualified counts is:

$$(P+U)^2 = PP + UP + PU + UU.$$

The right side of each term determines the nature of the count, whether of preference, P, or unpreference, U.

The left side of each term determines whether the redistribution of the votes in that count is of preferred or unpreferred candidates. These are defined as candidates who have reached a quota, respectively of election or exclusion.

As there may be more than one candidate, so defined, whose votes qualify for a redistribution count, the resulting keep values, from

those redistribution counts, must be averaged. In this case, the suitable average is the common arithmetic mean. The redistributions are all measures of the same kind, or class, of count, a measure of uniformity.

(It takes the geometric mean to average keep values from different kinds of counts, election and exclusion. The arithmetic mean does not work, when tried, in this case.)

If discussion of averages goes beyond the arithmetic mean, the geometric mean and the harmonic mean are the next stops. (As we found from discussion of Borda method.)

As for the power harmonic mean, I had to find that out for myself, to match four scales of measurement to four averages. Then I had to figure out why it seemed suitable to the averaging of orders of binomial expansions, in Binomial STV.

Three standard Averages and Power Harmonic Mean as Average Four

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November 2017, I adopted a third average, the arithmetic mean, for error-reducing purposes, in my system of Binomial STV.

Above discussion, of higher order counts, proposed an arithmetic mean of redistribution counts, with respect to those candidates, who have at least a quota, thus qualifying as preferred candidates in an election count, or unpreferred candidates in an exclusion count. This averaging of redistribution results, would be more stable than redistributing the votes, only of one most preferred candidate, with surplus votes, in an election count, or the votes of one most unpreferred candidate, with surplus votes, in an exclusion count.

Any higher order count is systematised by the (non-commutative) binomial theorem, into qualified recounts, by redistributing votes of quota-reaching candidates. For more than one quota-reaching candidate, the arithmetic mean keep values are taken of each redistribution count result.

Besides arithmetic mean (AM) redistribution counts, the geometric mean (GM) was used to average candidates keep values from both election and exclusion counts. The harmonic mean (HM) neutralised democratic objections to the maximum and minimum proportional counts by the Hare and Droop quotas.

When young, I wrote an article that the single transferable vote uniquely follows the four main scales of measurement, widely accepted in the sciences. (It has a copyright UNESCO, 1981. The French translation is still extant, and has now been published

separately, as a booklet, entitled: *Modele Scientifique du Proces Electoral*. Another essay is a French translation of an above chapter.)

It occurred to me that the three averages (AM, GM & HM) corresponded to these recognised scales. The harmonic series, which the harmonic mean averages, is a ratio scale, which is the fourth scale of measurement.

The third scale, the interval scale, is also a proportional scale, but lacks a true zero, unlike the ratio scale. It so happens that the geometric mean cannot work with a zero, in a given series, because that would reduce the geometric mean to zero, a non-result.

The first, and simplest of the four scales, the nominal or classificatory scale is the most obvious candidate to correspond to the simplest average, the arithmetic mean, of the distribution of a class of objects or classification.

The second scale of measurement is the ordinal scale or ranking. If this also has a corresponding average, there should be 4 averages for 4 scales. But what is the missing average? (When I looked, Wikipedia article, *Averages*, groups together just three basic averages: arithmetic, geometric, and harmonic means.)

So, I played blind mans buff, fumbling for a fourth basic average in the group, and wondering whether there really was one. After a bit of thinking on the character of the geometric mean, I stumbled upon this apparently unknown average, making-up the quartet. (It seemed a long time, over an uncertain effort, but the discovery of a fourth average came only a few days after I realised that the arithmetic mean was needed as a third average for Binomial STV.)

I had a clue: the geometric mean is a power arithmetic mean. So, the unknown mean must be a power harmonic mean. This is explained with an example.

An arithmetic series increases by a constant amount, for instance, two, in the following distribution: 2, 4, 6, 8, 10, etc.

For, the calculation for the arithmetic mean, of a perfectly regular arithmetic series, letting the minimum be $N = 2$, and the maximum be $X = 32$.

Then, arithmetic mean is: $(N+X)/2$.

The division is by two, because N & X are two items. Three items would be divided by three, and so on.

In this example, $AM = (2+32)/2 = 17$.

This would be the average of a uniform increase from two to thirty-two.

The next distribution is a geometric series, because it does not merely add a constant number, to every successive member, but multiplies by two. The series doubles in size with every successive member:

2, 4, 8, 16, 32.

The series does not just go up by (one number) two. It goes up by one two, two twos, four twos, eight twos. The constant change (of two), becomes a changing change (of two, in this example).

The average member of this geometric series can be found by the geometric mean. This example is a completely regular series, so it can be calculated simply by multiplying the two end members of the

range, 2 by 32 equals 64, and taking the square root, for a geometric mean of 8.

This calculation can also be done, by using indices (indicated by the circumflex, ^) where $2 = 2^1$ (which means 2 to the power of 1) and $32 = 2^5$ (which means 2 to the power of 5).

Then, the geometric mean equals: $\{(2^1)(2^5)\}^{1/2} = 2^{(1+5)/2} = 2^3 = 8$, which is the result, for the geometric mean, which we had before.

Notice that the calculation, in the power index, is the same as the calculation for the arithmetic mean.

A third average, the harmonic mean is the average of a harmonic series, like;

$1/2, 1/4, 1/6, 1/8, 1/10$.

Its terms are the inverse of an arithmetic series. This example is perfectly regular, so just take the end terms and invert them. $1/2$ and $1/10$ become two and ten. Add them, divide by two, to get six. Then invert again to get the harmonic mean, which is $1/6$, as is apparent from looking at the middle term of the above harmonic series.

The available calculation for the unknown average, or unknown mean, is a power index, using the harmonic mean, instead of the (geometric mean as) power arithmetic mean.

Take a power harmonic series, like:

$1/2, 1/4, 1/8, 1/16, 1/32$.

This is the inverse terms of a geometric series, as the harmonic series has the inverse terms of an arithmetic series.

Again, we could express this series to the power of two:

$$1/(2^1), 1/(2^2), 1/(2^3), 1/(2^4), 1/(2^5).$$

To find the power harmonic mean of this regular series, most simply, invert the end terms to get 2^1 and 2^5 .

$$\text{Multiply them: } 2^1 \times 2^5 = 2^{(1+5)} = 2^6.$$

Take the square root, which is: $2^{(6/2)} = 2^3$. Invert again to get the power harmonic mean of $1/8$, in the middle of the above power harmonic series.

Suppose, we had a collection of data, called a "population," which formed some unknown distribution or pattern of information, which we wanted to know. If the data formed a reasonably regular pattern and we knew the limits of its range. And if we had some idea of its average or most typical item, then we could tell, for instance, whether the data formed one of the four distributions already mentioned. (Of course, in reality, it might not form any of them.)

As a simple example, suppose we know the minimum, N , and the maximum, X , values of a distribution to be, respectively, 2 and 32. But we cannot make out what pattern the internal data falls into. So we try each average, to find which one looks the most representative of the data in question.

The arithmetic mean was calculated above (at 17). And the geometric mean was calculated (at 8).

$$\text{The harmonic mean is: } 1/\{(1/N)+(1/X)\}/2.$$

$$\text{In this example: } HM = 1/\{(1/2)+(1/32)\}/2 =$$

$$1/\{(17/32)\}/2 = 64/17 \sim 3.76.$$

Now for the unknown average, which is the power harmonic mean:

$$2^{[1/\{(1/n)+(1/x)\}/2]}.$$

For the above example, $N = 2^n$, being: $2 = 2^1$. And $X = 2^x$, being: $32 = 2^5$.

The power harmonic mean is:

$$2^{[1/\{(1/1)+(1/5)\}/2]} = 2^{[1/(6/10)]} = 2^{(5/3)} \sim 3.17.$$

(Note that two is not the only base, to the power, that could be used. It applies to a series, which gives the first few sums of the binomial theorem, for ascending powers, assuming the two terms, in its factor, are both equal to 1. And one plus one equals two, for the base.)

From the above example, the four averages are:

AM = 17; GM [power arithmetic mean] = 8; HM $\sim$ 3.76; new average [power harmonic mean] $\sim$ 3.17.

The three recognised averages AM, GM, HM are generally of descending magnitude. As to be expected, my innovation of the power harmonic mean has the smallest magnitude of the four averages.

What to call the power harmonic mean? The inverted terms of the arithmetic mean form the harmonic mean. The inverted terms of the geometric series (a power arithmetic mean) form the power harmonic mean.

The difference between the two power means can be expressed by changing a term in the binomial factor from a whole number or term, say, x , to its inverse, $1/x$. Their expansions respectively generate geometric mean, in ascending powers of x , in the successive term

numerators, or, power harmonic mean, in ascending powers of x , in the successive term denominators.

In terms of Binomial STV, the P for Preference count term may be set at unity. If the U for Unpreference term may be set at some fraction less than one, then the expansion generates a power harmonic mean.

Indeed, the weight of the unpreference count may be less than the preference count, because reverse preferences give-up weight to the count of abstentions, which are usually at the end of ballot papers.

The power harmonic mean is the fourth average to be used for FAB STV. It is concerned with averaging the final keep value results from orders of binomial STV, first order, second order, etc, STV^n .

It so happens, that the ordinal scale is the last of four recognised scales of scientific measurement, awaiting a corresponding average.

[Aside: I once translated traditional differentiation into ultimate averagings either of the arithmetic mean or the harmonic mean. Differential calculus could be given a statistical basis. It also followed that there should be a geometric mean (power arithmetic mean) differentiation, and I tried to secure a landing on that unknown continent of knowledge.

Given a power harmonic mean, this opens-up the prospect, also, of a power harmonic mean differentiation. That is all very tentative, I know. But I have found that putting mathematics on a statistical basis works well.]

To get back on topic, a few final words about how the power harmonic mean might be applied, as the fourth average to be used on Binomial STV. There are orders of FAB STV, which are bound to get slightly different keep values for the candidates, tho not much

alter the results. Based on successive expansions of the binomial theorem, there is first, second, third etc order (Binomial) STV, whose respective keep value results might be averaged by the power harmonic mean.

This practical possibility may relate (somewhat!) this new average to the ordinal scale, so that all four scales of measurement have a related basic average.

Just take the first and second order STV counts, as all that's needed to give an idea of the principle.

Let K be a first order keep value, where $K = 2^a$, and let k be a second order keep value, where $k = 2^b$.

The power harmonic mean (PHM) keep value would be:

$$\text{PHM} = 2^{1/\{(1/a)+(1/b)\}/2}.$$

This concludes an explanation of my new average, and its possible first application, by way of the averaged keep values of successive orders of Binomial STV.

Application of all four averages to Binomial STV is given the abbreviation: FAB STV.

This study illustrates that a particular practical problem can discover a result of general application. The power harmonic mean represents a fourth distinct data distribution pattern from three traditionally recognised in statistics.

Example of Four Averages Binomial STV

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The following table 0 was taken from a real election of 5 representatives from 21 candidates, by 10 voters. The 10 voters all have listed a complete range of preferences for all 21 candidates. (Source: Brian Wichmann, former editor of Voting Matters.)

It is not necessary for the voters to express all preferences, with FAB STV, because any preferences, not given by the voters, count towards abstentions. If a voter returned a completely blank ballot paper that would count as the voters whole vote for none of the candidates: None Of The Above (NOTA). That NOTA vote would count towards a quota of votes to leave one of the seats empty, in the election.

So, FAB STV uses all the preference information, expressed or unexpressed. Abstentions generally occur after the voters have expressed their first few most preferred candidates, for election. FAB STV conducts an exclusion count, as well as an election count. The exclusion count reverses the order of preferences, given in table 0. Then, the most important preferences are the last preferences. If these last preferences are abstentions, they need to be counted, to be given their due weight or importance. Merely starting the reverse count, at the last expressed preferences, would give them an undue importance, compared to the first preferences, in the election count.

Settling the relative importance of the election count and the exclusion count, in this way, matters, because the final result of the FAB STV count, as a whole, is determined by averaging the results of the election count and the exclusion count.

This is done by inverting candidates exclusion count keep values,

effectively turning them into alternative election count results. Then the election count results and alternative election count results can be averaged for a final and more representative result.

This process was made possible by the concept of the keep value, used by Brian Meek, in Meek method STV. FAB STV is an extension of Meek method, a very considerable extension, when all is said and done.

The keep value measures how close any candidate is to election. It is in the form of a ratio. Its numerator is the quota, or elective proportion, of the votes, any candidate needs to win a seat, in a multi-member constituency. The ratio denominator is the number of votes any given candidate accumulates, as the count progresses.

If a candidate obtains exactly the number of votes, required by the quota, the keep value is exactly one, which signifies that candidate is elected, with no transferable surplus of votes to a next preference. The distinction of Meek method, from traditional STV, is that its computer program count can continue to up-date an elected candidates vote, and therefore revise their keep value.

As an elected candidates vote grows beyond the quota, from receiving further preferences, the ratio of the keep value diminishes from unity into a fraction. The candidate with the biggest margin of votes over the quota has the smallest keep value, and is, by that token, the single most preferred or popular candidate.

Any voter, for that most popular candidate, need only give that small fraction, of their one vote, to secure that candidates election, because all that preferred candidates other voters are enough in number, to make up that candidates quota, each with just that fraction of their vote. That fraction is the fraction that the candidate keeps - the keep value - to secure election.

(Long before the concept of the keep value was introduced, HG Wells explained well how more voters than a quota, for a candidate, only need to give a proportionate fraction of their vote to that candidate. "The Angels Weep: H.G. Wells on Electoral Reform." Edited with a post-script by Richard Lung.)

The keep value, for electing a preferred candidate, is only a fractional part of each voters one vote. The remaining fraction of that one vote is a transferable surplus to next preferred candidates, and is called the surplus value. Hence, keep value plus surplus value equals one vote.

Meek method only counts the keep values of candidates elected, that is with keep values of one or less. But FAB STV also counts the keep values of candidates not yet elected. Their votes are so far less than the quota, which means that their keep values are greater than one. And they have negative surplus values (which merely means a deficit) because, for one person one vote, keep value plus surplus value must always equal one.

The big advantage of keep values for all candidates, whether in surplus or deficit of the quota, is that they furnish a standard of comparison for all candidates relative popularity. More representative count results are made possible, by averaging all the candidates respective keep values from both an election count and an exclusion count.

The appropriate average of election and exclusion counts proves to be the geometric mean. This relates to the nature of counting a transferable vote, where, stage by stage, the weight given to later preferences, the surplus value of the vote, falls exponentially (or "geometrically").

The geometric mean was the first of eventually four averages I applied to my invention of Binomial STV.

Table 0: 10 voters preferences for 21 candidates.

1	A	K	E	B	R	F	L	I	N	P	T	Q	J	M	O	D	C	S	U	G	H
2	B	E	R	A	O	C	N	F	I	P	L	D	K	Q	G	S	T	U	J	H	M
3	O	G	F	S	C	M	A	K	B	T	L	R	E	H	P	J	D	I	N	U	Q
4	G	K	D	M	P	R	Q	A	F	H	L	N	S	U	B	I	C	J	O	T	E
5	H	I	B	Q	E	O	M	F	R	A	K	N	P	C	L	U	S	T	D	J	G
6	A	F	G	I	M	T	C	E	H	K	U	D	N	O	P	Q	B	L	J	R	S
7	O	M	H	P	B	K	A	N	Q	I	C	J	F	L	R	S	U	T	D	E	G
8	L	G	F	O	A	C	M	J	E	N	S	K	R	D	Q	P	B	I	T	H	U
9	K	H	B	J	A	T	I	E	O	N	C	D	L	M	R	Q	G	U	P	S	F
10	K	B	E	T	N	I	A	H	C	M	F	P	R	U	J	L	G	D	O	Q	S

First order count (STV^1) of FAB STV

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Another of the averages in Four Averages Binomial STV was the Harmonic Mean. This derives from my innovation of the Harmonic Mean quota. This is the average of the maximum quota (the Hare quota) and the minimum quota (the Droop quota).

It is statistically advisable to take the HM quota, briefly for these reasons. The Hare quota requires everyone to agree on the winner of a single vacancy, so one candidate is elected only by winning all the votes. This is the exception rather than the rule, usually requiring exceptional deference, on behalf of all the voters, to one point of view.

At the other extreme, the Droop quota requires only half the voters to win a single vacancy. If another candidate also has half the votes, the winner is decided at random.

A majority of one, or a relatively few votes advantage, is not a statistically significant victory. It may be only the chance outcome of minor disturbing factors, like the weather, biasing the result.

The Hare quota and the Droop quota are both a harmonic series, so their appropriate average is the harmonic mean. Hence, the Harmonic Mean quota.

Hare quota equals votes, V , divided by seats, S : V/S .

Droop quota equals votes, V , divided by one more than the seats, $S+1$: $V/(S+1)$.

The harmonic mean is obtained by inverting the terms, to be averaged, and dividing by the number of terms, before reversing the inversion. In this case, invert V/S and $V/(S+1)$ and divide by two:

$$S/V + (S+1)/V = (2S+1)/V.$$

Dividing by two:

$$(2S+1)/2V = (S + 1/2)/V.$$

Reverse inversion for the harmonic mean. Therefore, the Harmonic Mean quota is: $V/(S + 1/2)$.

I have used this quota, in the example, instead of the usual Droop quota, the lowest possible bar for a proportional count, giving the maximum chance that all the seats would be filled. But I guessed that five seats would give a proportional enough count, to allow raising the bar for election, somewhat, with the Harmonic Mean

quota. In fact, the counts with different quotas doesn't alter the relative positions of the candidates.

(Thus, STV[^] is not prone to different quota levels, independently of voter preferences, producing different election results. FAB STV is free of the "irrelevant alternatives" objection, by theorem Arrow in social choice theory.)

In the following example of FAB STV, the (Harmonic Mean) quota is: $10/(5 + 1/2) = 1.8182$ (to 4 decimal places).

Table 1: 1st order count of Preferences (P).

Candid-ates	1st prefs.	1st prefs. keep value	surplus transfer	post-trans-fer keep value
A	2	0.9091	1.8182	0.9091
B	1	1.8182	K-> 1.0909	1.6667
C				
D				
E			A->K-> 0.0909	20.0022
F			A-> 0.0909	20.0022
G	1	1.8182	O-> 1.0909	1.6667
H	1	1.8182	K-> 1.0909	1.6667
I				
J				

K	2	0.9091	2.0909 A-> 1.8182	0.8696
L	1	1.8182	1	1.8182
M			O-> 0.0909	20.0022
N				
O	2	0.9091	1.8182	0.9091
P				
Q				
R				
S				
T				
U				
Total votes	10		10.0000	

In the surplus transfer column, I have put a letter, followed by a little arrow, showing what candidate a surplus vote has come from, to a next preferred candidate (each candidate identified by row).

The keep values are calculated as a ratio of the quota to a candidates number of votes. Thus, a candidate with first preferences of one vote has the same keep value as the quota. The same votes as the quota elects the candidate on a keep value of unity. More votes, for a candidate than the quota, elects the candidate with a transferable surplus to next preferred candidates. Elected candidates with surpluses have keep values at a fraction of one. The biggest surplus translates into the smallest keep value

Thus candidate, K, is the most preferred candidate with the smallest keep value of 0.8696. That is, in this round. But FAB STV is a

distinctive version of STV in having potentially many rounds.

As with Meek method, FAB STV continues to count any surplus transfers to an already elected candidate. (This level of consistency is only practical with computer counting.) Thus, candidate K has 2 first preferences, but also receives a surplus, as a voters second preference to candidate A. This increases the surplus, and thereby decreases the keep value, possessed by K.

First order FAB STV has two counts, the above election count of preferences. And an exclusion count of reverse preferences or unpreferences. Apart from counting with table 0, from right to left, instead of left to right, the exclusion count is conducted exactly like the election count. Indeed for purposes of comparing and averaging the two counts, it is strictly necessary that they should be conducted equivalently.

Table 2: 1st order exclusion count of Unpreference (U).

Candid -ates	1st prefs.	1st pref. keep value	surplus transfer	post- transfer keep value
A				
B				
C				
D				
E	1	1.8182	G-> 1.0909	1.6667
F	1	1.8182	1	1.8182
G	2	0.9091	1.8182	0.9091
H	1	1.8182	1	1.8182
I				

J			G-> 0.0909	20.0022
K				
L				
M	1	1.8182	1	1.8182
N				
O				
P				
Q	1	1.8182	S-> 1.0909	1.6667
R			S-> 0.0909	20.0022
S	2	0.9091	1.8182	0.9091
T				
U	1	1.8182	1	1.8182
Total votes	10		10.0000	

Two candidates, G and S, have surpassed the quota for most unpreferred candidates. Solely on the basis of this exclusion count, these candidates would be eliminated from the contest. But Binomial STV is based on a balanced averaging of both election count and exclusion count, to make a final determination.

The exclusion count keep values are inverted to provide an alternative election count, which then can be averaged with the election count, to give a more representative result, based on a fuller use of the preference information of table 0, as shown in table 3.

Table 3. STV¹: averaged election and exclusion count keep value results.

Candid-ates	Pref. (P) keep value	Inverse Unpref. (1/U) keep value	P/U	$\sqrt{(P/U)}$: geometric mean keep value
A	0.9091			
B	1.6667			
C				
D				
E	20.0022	0.6	12.0013	3.4643
F	29.0022	0.55	11.0012	3.3168
G	1.6667	1.1	1.8334	1.3540
H	1.6667	0.55	0.9167	0.9574
I				
J				
K	0.8696			
L	1.8182			
M	20.0022	0.55	11.0012	3.3168
N				
O	0.9091			
P				
Q				
R				
S				
T				
U				

The results of the first order Binomial STV election (an election count of preference combined with an exclusion count of unpreference) are now in. This is an election system, in its own right, perhaps as far as the great majority of elections need to be carried out, especially if it used the lower threshold of the modern standard STV quota, the Droop quota. In fact, I have done this, in Supplement 3. It elects the same candidates and runner-up. As one would expect, the lower quota gives a more generous assessment of the candidates keep values.

Table 3 shows three candidates, A, K, O clearly elected. They all have preference keep values of less than one. They are all clear of unpreference votes, and so are unconditionally elected. Candidate K, with the lowest keep value, may be considered first among equals.

Candidate H is among the more preferred, benefiting from a small surplus value, as a next preference, besides a first preference vote. This is not enough to reach the preference quota. But the fractional vote against H is well below the unpreference quota. So, that on average, H squeaks home to take the fourth seat.

No candidate has a quota-level keep value, of one or less, to take the fifth seat. The runner-up, with the lowest remaining keep value, 1.354, is for candidate G.

This would not be a problem for the returning officer, in a traditional STV count, because the rules would usually specify that the last remaining seat may fall to the candidate, with the plurality of votes among still unelected candidates.

In the last resort, of a final vacant seat, conventional STV may degenerate to a First Past The Post exercise - meaning that FPTP may be degenerate to start-with!

However, the philosophy of Binomial STV differs from traditional

elections, where it is required that all the seats be filled. This is not necessarily the case with Binomial STV, either at its most basic or elaborate, because all preferences are counted, including abstentions, which may generate a quota for leaving a seat vacant.

In our example of a real election, no such abstentions quota is generated, indeed no abstentions are recorded, so it would be reasonable for the runner-up to take the still vacant fifth seat.

Nothing much statistically significant can be said about the wishes of such a small sample of ten voters, spread amongst over twice as many candidates. Never the less, this mini-election is a most convenient means of demonstrating my new electoral system.

The voters would have to number at least about 32 to profile anything resembling a binomial distribution, which would indicate a random distribution of voter opinion of the candidates. The larger the distribution, the more confidence can be put in statistical tests of the significance of vote levels for the candidates.

For instance, we could measure (in terms of the number of standard deviations), to successive levels of probability, whether any candidates margin of election or failure to achieve election surpassed mere chance.

A candidate, who has missed a final vacancy, in a multi-member constituency, by a statistically insignificant amount, might still be deemed elected. That would depend on whether the electoral law of the land, using FAB STV, included a specific provision to that effect.

First order Binomial STV, with standard Droop quota, is only a one average Binomial STV. The one average is the geometric mean, used to average the election and exclusion count keep values. Using the Harmonic Mean quota brings to a two averages Binomial STV.

A third average, the arithmetic mean comes into play with second order and higher order STV.

Four Averages Binomial STV (FAB STV) combines results, at least, of first order and second order Binomial STV. Like first order Binomial STV, the second order Binomial STV result is a result, in its own right. Tho, each order result, on its own, cannot be more than a three averages Binomial STV.

Second order Binomial STV (STV²).

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The first order Binomial STV system of counts is based on the first order bi-nomial distribution, where the bi- signifies two variables, in this case, of Preference, P, and Unpreference, U.

The binomial theorem, to the first power, which means multiplied by itself once, leaves it the same: $(P+U)^1 = (P+U)$.

This simple factor stands for a Preference count and an Unpreference count, namely first order Binomial STV.

The second order binomial distribution of STV recounts is based on the binomial theorem taken to the second power:

$$(P+U)^2 = PP + UP + PU + UU.$$

The expansion is non-commutative, because the operations UP and PU are not the same, and so cannot be counted as the same operation twice over.

What do these operations signify? For a long time, my interpretation was too simplistic, tho it served well enough, in a rough and ready way - rather as does traditional STV, still by far the best working election system.

Take the PP operation. This stands for a preference count, presumably qualified by redistributing the votes of candidates, defined as preferred by having at least a quota. It would be most convenient to just redistribute the votes of the candidate with the biggest surplus. Eventually I realised, that ensuring a more typical

result required a recount for each preferred candidates vote redistribution.

Preferred candidates were defined as those having at least a quota, to qualify for their total vote to be redistributed in a (second or higher order) qualified election count. Unpreferred candidates were defined as quota-reaching candidates qualifying for total vote redistribution in a qualified exclusion count.

The keep values, of the candidates having their votes redistributed, are unchanged by the operation, and duly registered in the PP recount tables.

In this little example there are three such (quota-surpassing) preferred candidates, A, K, O, whose preference votes are up for redistribution in three preference-qualified preference counts (PP). The resulting keep values of these three PP counts can then have their representative average found, by taking their arithmetic mean.

This technique now brought my system up to a three averages Binomial STV.

Table 4. PP1: Preference-qualified Preference count 1, on redistributing votes of candidate A.

Candid-ates	Redist-rib. A votes	1st stage keep value	Surplus transfer	Post-transfer keep value
A	---	0.9091		0.9091
B	1	1.8182	K-> 1.0909	1.6667
C				

D				
E			A->K 1	1.8182
F	A-> 1	1.8182	1	1.8182
G	1	1.8182	O-> 1.0909	1.6667
H	1	1.8182	K-> 1.0909	1.6667
I				
J				
K	A-> 3	0.6061	1.8182	0.6061
L	1	1.8182	1	1.8182
M			O-> 0.0909	20.0022
N				
O	2	0.9091	1.8182	0.9091
P				
Q				
R				
S				
T				
U				
Total votes	10		10.0000	

Without more ado, we go to the next two PP tables, PP2 & PP3, for redistributing the votes of K and O.

Table 5. PP2: 2nd Preference-qualified Preference redistribution count (of votes for candidate K).

Candid-ates	K votes redist -ribn.	K re- distn. keep value	surplus transfer	surplus transfer keep value
A	2	0.9091	1.8182	0.9091
B	K-> 2	0.9091	K->H 1.9091-> 1.8182	0.9091
C				
D				
E			A-K; B-> K->B 0.2727	6.6674
F			A-> 0.0909	20.0022
G	1	1.8182	O-> 1.0909	1.6667
H	K-> 2	0.9091	1.8182	0.9091
I			H-> 0.0909	20.0022
J			K->H->B-> 0.0909	20.0022
K	---	0.9091	---	0.9091
L	1	1.8182		1.8182
M			O-> 0.0909	20.0022
N				
O	2	0.0901	1.8182	0.9091
P				

Q				
R				
S				
T				
U				
Total votes	10		10.0000	

Table 6. PP3: 3rd Preference-qualified Preference redistribution count (of votes for candidate O).

Candid-ates	O votes redist-ribn.	redistn. keep value	surplus transfer	post-transfer keep value
A	2	0.9091	1.8182	0.9091
B	1	1.8182	K-> 1.0909	1.6667
C				
D			G->K-> 0.0909	20.0022
E			A->K-> 0.0909	20.0022
F			A->; O->G-> 0.1818	10.0011
G	O-> 2	0.9091	1.8182	0.9091
H	1	1.8182	K-> 1.0909	1.6667
I				
J				

K	2	0.9091	A-> G-> 2.1818 -> 1.8182	0.5414
L	1	1.8182	1	1.8182
M	O-> 1	1.8182	1	1.8182
N				
O	---	0.9091		0.9091
P				
Q				
R				
S				
T				
U				
Total votes	10	10.0000		

In the redistribution of votes from candidate O, and subsequent transfer of surplus votes from quota-achieving candidates, candidate K already has a surplus and receives a further surplus value, as the next preference of two candidates voters. This further lowers the keep value for K. And means that K has a larger surplus vote to transfer to (four) more next preferences.

Table 7. PP: Arithmetic Mean keep values of 3 Preference-qualified Preference redistribution counts (tables 4-6).

Candid-ates	A redist-ribn. keep value	K redist-ribn. keep value	O re-distrib. keep value	A.M. PP keep value

A	0.9091	0.9091	0.9091	0.9091
B	1.6667	0.9091	1.6667	1.4142
C				
D			20.0022	
E	1.8182	6.6674	20.0022	9.4959
F	1.8182	20.0022	10.0011	10.6072
G	1.6667	1.6667	0.9091	1.4142
H	1.6667	0.9091	1.6667	1.4142
I		20.0022		
J		20.0022		
K	0.6061	0.9091	0.5414	0.6855
L	1.8182	1.8182	1.8182	1.8182
M	20.0022	20.0022	1.8182	13.9409
N				
O	0.9091	0.9091	0.9091	0.9091
P				
Q				
R				
S				
T				
U				

Table 7 averages the candidates keep values, for the PP (Preference-qualified Preference) count. This is just one of the four qualified counts required by second order Binomial STV. The other qualified preference count is the Unpreference-qualified Preference count (UP).

The procedure for all four counts is the same, merely taking, in turn, the four logically possible combinations of count, given by a second order binomial distribution.

Table 8. UP1: First Unpreference-qualified Preference count, redistributing vote of candidate G.

Candid-ates	G votes redist -ributn.	redist -ribn. keep value	surplus transfer	post- transfer keep value
A	2	0.9091	1.8182	0.9091
B	1	1.8182	K-> 1.0909	1.6667
C				
D			G->K-> 1	1.8182
E			A->K-> 0.0909	20.0022
F			A->; O->G-> 0.1818	10.0011
G	---	1.8182		1.8182
H	1	1.8182	K-> 1.0909	1.6667
I				
J				
K	G-> 3	0.6061	1.8182	0.6061
L	1	1.8182	1	1.8182
M			O-> 0.0909	20.0022

N				
O	2	0.9091	1.8182	0.9091
P				
Q				
R				
S				
T				
U				
Total votes	10		10.0000	

An other candidate, to G, with a surplus of unpreference votes, for the second unpreference-qualified preference count (UP2), is candidate S. But S has no preference votes to redistribute for a preference count, so the zero S votes redistribution count (UP2) is equivalent to the unqualified 1st order preference count (P). (Normally this equivalence would not happen. It only occurs here because the electorate is a mere ten voters!)

Since $UP2 = P$, this does not need to be calculated with its own table, and we go straight to the final UP table for the arithmetic mean keep values of the keep values for the two redistributions of votes, from G (UP1), and from S (UP2).

Table 9. UP: arithmetic mean keep values of the unpreference-qualified preference redistribution counts of votes from G & S.

Candid-ates	G redist-ribn. keep value	S redist-ribn. keep value (=P)	A.M. keep value

A	0.9091	0.9091	0.9091
B	1.6667	1.6667	1.6667
C			
D	1.8182		
E	20.0022	20.0022	20.0022
F	10.0011	20.0022	15.0016
G	1.8182	1.6667	1.7424
H	1.6667	1.6667	1.6667
I			
J			
K	0.6061	0.8696	0.7378
L	1.8182	1.8182	1.8182
M	20.0022	20.0022	20.0022
N			
O	0.9091	0.9091	0.9091
P			
Q		1.6667	
R		20.0022	
S		0.9091	
T			
U		1.8182	

Having done the two qualified preference counts, PP and UP, we now do the two qualified unpreference counts, UU and PU.

Table 10. UU1: First Unpreference-qualified Unpreference count redistributing votes for candidate G.

Candid-ates	G votes redist-	G redist -ribn.	surplus transfer	post- transfer
-------------	--------------------	--------------------	---------------------	-------------------

	ributn.	keep value		keep value
A				
B				
C				
D			G->E-> 0.0909	20.0022
E	G-> 2	0.9091	1.8182	0.9091
F	1	1.8182	1	1.812
G	---	0.9091		0.9091
H	1	1.8182	1	1.8182
I				
J	G-> 1	1.8182	1	1.8182
K				
L				
M	1	1.8182	1	1.8182
N				
O				
P				
Q	1	1.8182	S-> 1.0909	1.6667
R			S-> 0.0909	20.0022
S	2	0.9091	1.8182	0.9091
T			E-> 0.0909	20.0022
U	1	1.8182		1.8182
Total votes	10		10.0000	

Table 11. UU2: Second Unpreference-qualified Unpreference redistribution count from votes for candidate S.

Candid-ates	S votes redist-ributn.	surplus transfer	post-transfer keep value
A			
B			
C			
D			
E	1	G-> 1.0909	1.6667
F	1	1	1.8182
G	2	1.8182	0.9091
H	1	1	1.8182
I			
J		G-> 0.0909	20.0022
K			
L			
M	1	1	1.8182
N			
O		S->Q-> 0.0909	20.0022
P			
Q	S-> 2	1.8182	0.9091
R	S-> 1	1	1.8182
S	---		

T			
U	1	Q-> 1.0909	1.6667
Total votes	10	10.0000	

Table 12. UU: Arithmetic Mean Unpreference-qualified Unpreference count keep values (of UU1 & UU2).

Candid -ates	G redist -ribn. keep value (UU1)	S redist -ribn. keep value (UU2)	A.M. keep value (UU)
A			
B			
C			
D	20.0022		
E	0.9091	1.6667	1.2879
F	1.8182	1.8182	1.8182
G	0.9091	0.9091	0.9091
H	1.8182	1.8182	1.8182
I			
J	1.8182	20.0022	10.9102
K			
L			
M	1.8182	1.8182	1.8182
N			
O		20.0022	
P			
Q	1.6667	0.9091	1.2879

R	20.0022	1.8182	10.9102
S	0.9091	0.9091	0.9091
T	20.0022		
U	1.8182	1.6667	1.7424

The fourth and last second order combination, PU, is especially easy, in this minute election, because surplus preference candidates, A, K, O, have been given no last preferences, or first unpreference votes, to be redistributed, in qualification of the Unpreference count. Therefore the keep values of this PU combination are just those of the first order (unqualified) Unpreference count. Normally, with substantial numbers of voters, all four categories require the use of the arithmetic mean to average the qualified keep values from quota-reaching candidates redistributed votes.

With the arithmetic mean (of the same kind of counts or uniform counts), we have come across three out of the four averages to FAB STV: the harmonic mean (in the Harmonic Mean quota), the geometric mean (of non-uniform counts).

We now have (arithmetic mean) keep values of the four categories, to calculate second order Binomial STV. We can do it in stages. First the average (geometric mean) keep values of the qualified preference counts, PP & UP, in table 13.

Table 13. Geometric Mean (GM) keep values of qualified Preference counts (PP & UP).

Candid-ates	PP keep value	UP keep value	Qualified pref. keep values GM: $\sqrt{(PP \times UP)}$

A	0.9091	0.9091	0.9091
B	1.4142	1.6667	1.5353
C			
D			
E	9.4959	20.0022	13.7818
F	10.6072	15.0016	12.6145
G	1.4142	1.7424	1.5697
H	1.4142	1.6667	1.5353
I			
J			
K	0.6855	0.7378	0.7122
L	1.8182	1.8182	1.8182
M	13.9409	20.0022	16.6988
N			
O	0.9091	0.9091	0.9091
P			
Q			
R			
S			
T			
U			

Table 14. G.M. keep values of qualified unpreference counts (UU; & PU = U).

Candid -ates	UU keep value	PU (= U) keep value	Qualified unpref. keep values GM: $\sqrt{(UU \times PU)}$

A			
B			
C			
D			
E	1.2879	1.6667	1.4651
F	1.8182	1.8182	1.8182
G	0.9091	0.9091	0.9091
H	1.8182	1.8182	1.8182
I			
J	10.9102	20.0022	14.7725
K			
L			
M	1.8182	1.8182	1.8182
N			
O			
P			
Q	1.2879	1.6667	1.4651
R	10.9102	20.0022	14.7725
S	0.9091	0.991	0.9091
T			
U	1.7424	1.8182	1.7802

Having gathered the qualified preference keep values (table 13) and qualified unpreference keep values (table 14), we can now calculate the over-all second order binomial STV (STV^2) keep values, by multiplying the former by the inverse of the latter, and taking the multiples square roots (table 15).

Table 15. STV² keep values: G.M. of (A.M. averaged) qualified preferences times inverse qualified unpreferences.

Candid -ates	(1) $\sqrt{(\text{PPxUP})}$	(2) $\sqrt{(\text{UUxPU})}$	2nd order keep value: $\sqrt{\{(1)/(2)\}}$
A	0.9091		
B	1.5353		
C			
D			
E	13.7818	1.4651	3.0670
F	12.6145	1.8182	2.6340
G	1.5697	0.9091	1.3140
H	1.5353	1.8182	0.9189
I			
J		14.7725	
K	0.7112		
L	1.8182		
M	16.6988	1.8182	3.0306
N			
O	0.9091		
P			
Q		1.4651	
R		14.7725	
S		0.9091	
T			
U		1.7802	

Table 15 gives the final second order STV count. Like the first order count, it is a result, in its own right. As higher orders of the STV count allow more vote transfers, the candidates keep values are reduced. However, the second order result still has not decisively changed the first order result.

The 1st & 2nd order keep values, respectively, for the five leading candidates are:

A: 0.9091 & 0.9091

G: 1.3540 & 1.3140

H: 0.9574 & 0.9189

K: 0.8696 & 0.7112

O: 0.9091 & 0.9091.

Table 16 averages the results of first order and second order STV counts, in terms of a Power Harmonic Mean. (This particular calculation is shown in detail with table 17.)

Table 16. Power Harmonic Mean (PHM) keep values of 1st & 2nd order Binomial STV.

Candid-ates	1st order keep value	2nd order keep value	PHM keep value
A			
B			
C			
D			
E	3.4643	3.0672	3.2495
F	3.3168	2.6340	2.9195

G	1.3540	1.3140	1.3328
H	0.9575	0.9189	0.9462
I			
J			
K			
L			
M	3.3168	3.0306	3.1652
N			
O			
P			
Q			
R			
S			
T			
U			

This completes the count of all four averages of the binomial single transferable vote (FAB STV).

The next section exemplifies, in table 17, how the fourth average, the Power Harmonic Mean, stated in table 16, was calculated.

Calculation of the fourth of Four Averages Binomial STV: Power Harmonic Mean of first and second order Binomial STV counts.

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An average is a representative item from a whole range of items. Each range has a characteristic distribution or pattern of items, Some average may better represent its character, or some aspect of its character, better than others.

Ranges themselves can be represented by an average of corresponding items in two or more distributions. This is what is being done here, by averaging the first and second order ranges of keep values.

The average used is my innovation of the power harmonic mean (PHM) of two binomial series, the binomial distributions of the first order and the second order. Tho, this averaging could be extended to any order of Binomial STV.

Because there were only 10 voters for 21 candidates, there simply wasn't enough data to go round to give complete information, to furnish the PHM keep values on more than five candidates.

In any but this sparsest of elections, a complete analysis would be possible. In that case, the mass of data, to process, would be impractical for a manual count.

That data absence doesn't detract from this minimalist election, because the main outlines of the result are apparent enough. Indeed, for demonstration purposes only, the blank spaces in the

tables may help keep at bay any number-blindness from unbroken regimental lines of figures. These are, after all, the computers job.

The following PHM calculations (for five of the candidates) require a program for transforming a number to its equivalent as a power to base two.

The binomial theorem is in terms of two to the power. Binomial STV is in terms of two equal units of preference and unpreference, inside (the bracketing factor of) the binomial theorem.

The base-two power program would be an essential part of a computer count of FAB STV.

(I did not have this. But for the sake of form, I worked out the necessary numbers, by trial and error, with the help of a scientific calculator.)

With reference to the values in table 17, the Power Harmonic Mean,
 $F = 2^f$

$$= 2^{1/\{(1/x)+(1/n)\}/2}.$$

Table 17. Steps to averaging 1st and 2nd order STV counts by the Power Harmonic Mean.

Can -did -ates	1st order keep value $X = 2^x$	2nd order keep value $N = 2^n$	x	n	f	PHM, $F = 2^f$
E	3.4643	3.0672	1.7926	1.6169	1.7002	3.2495
F	3.3168	2.6340	1.7298	1.3971	1.5457	2.9195
G	1.3540	1.3140	0.4372	0.3940	0.4145	1.3328
H	0.9575	0.9189	-0.0593	-0.1220	-0.0798	0.9462
M	3.3168	3.0306	1.7298	1.5996	1.6623	3.1652

Table 17 shows that the Power Harmonic Mean gives well-behaved averages, for every candidate. That is to say, the average falls well within the narrow upper and lower value range of the first and second order STV counts. That is despite the quite complicated set of steps taken to calculate it, in table 17.

It may be objected why do I not use the geometric mean again, for averaging orders of keep values, like for the above example of first and second orders keep values?

Binomial STV does average with the geometric mean, in election counts or mathematically similar exclusion counts, where surplus transfers fall off exponentially with successive stages of the count.

The geometric mean was used only for any given order of STV count. But the final stage of FAB STV is to average different orders of STV count, for which there may be reason to use a different average.

Compare the STV order counts using the geometric mean (power arithmetic mean) with the above results using the Power Harmonic Mean.

Table 18: Comparison of Power Harmonic Mean and Geometric Mean calculations for averaging 1st & 2nd order STV

Cand- idate	Power Harmonic Mean keep value	Geometric Mean keep value
E	3.2495	3.2597
F	2.9195	2.9557
G	1.3328	1.3339
H	0.9462	0.9380
M	3.1652	3.1705

Table 18 shows that the differences in the results between the two averages is tiny. However, the Power Harmonic Mean consistently weighs the result slightly towards the higher order result. This can be justified, because the latter is a refinement on the first order approximation, and therefore might be expected to carry ever so slightly more weight.

The geometric mean is an even-handed averaging, which is required of data collected in the same way, during the same order count. This is not the case when averaging different orders of data.

The geometric mean can be calculated the short way or the long way. The short way is to multiply a candidate's first order keep value by their second order keep value and take the square root. The same result is obtained by finding the first and the second order keep values equivalents to base two. Each power of two is then added and divided by two. The resulting power of two is then equated back to a keep value which is the geometric mean of the first and second order keep values.

The peculiarity of the Power Harmonic Mean is that only the long way works. The short way gives the same result as the geometric mean. That is because inverting and then re-inverting a multiple and square root makes no difference to the answer.

The long calculation, in terms of powers does make a difference, because, in the power index, the harmonic mean is calculated. This involves inverting terms before they are added (rather than multiplied) and then re-inverting them, which re-inversion process does make a difference.

The binomial series, which determines the system of counting, used in Binomial STV, might be considered as a factorial series.

The exponential series has ascending factorial terms in the denominators of successive terms, but is not, thereby, a factorial series (unless all the terms are inverted). The binomial series also has these same denominators, but it is the numerators of the binomial series, which are a function of uniformly changing factorials in successive terms, that have the claim to a factorial series.

The inverse terms of the arithmetic series make the harmonic series. The inverse terms of the geometric series make a factorial series. This hints that the power harmonic mean may be a factorial mean. The PHM would then be one of four basic averages representing one of four basic or "pure" series.

For coding Four Averages Binomial STV.

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The good news is that the basics for a FAB STV program already exist in Meek method STV, as used for some official elections in New Zealand.

That includes the consistent counting of all surplus transfers. Also the calculating of keep values, tho FAB STV extends this, to all candidates, including those still in deficit of a quota, using the same formula: keep value plus transfer value equals one.

Differences, from Meek method, include the counting of all preferences, including abstentions. Therefore, there is no (Meek method) reduction in the quota, as voters cease to express preferences.

The problem of coding Binomial STV (STV^1) also is made easier, because it is like a house that can be built one storey at a time. (The Russians used this construction method, just adding an extra storey as convenient.) Thus, first order Binomial STV (STV^1) is like the first storey of a house that is a complete building in its own right.

Second order Binomial STV (STV^2) indeed is built upon its first order version, by way of qualified recounts. And that is true of third order STV (STV^3) qualified recounts to second order STV.

No doubt, an algorithm for the successive expansions of the binomial theorem has been programmed for automatic computation already, and "just" would need adapting to Binomial STV higher order counts.

We needn't worry about that, in the first instance, for purposes of giving instructions, that coding has to follow, for first-order STV.

The Binomial STV (STV [^]) ballot paper.

Like other variants of STV, the STV[^] ballot paper requires voters to give their order of choice for candidates: 1, 2, 3,... etc.

To be counted, the preference numbers have to be put within the blank boxes adjacent to candidates names.

The candidates names and possibly pictures are listed, conventionally on the left-hand side of the ballot paper or screen, under the rules of Robson rotation, to neutralise unconscious bias in the voters choices of names for their own sake.

STV[^] differs from other ballot papers, traditional STV or otherwise, in that the column of candidates names is followed by spaces for as many names as there are seats to be filled.

A computer program has to allow for all logical possibilities. Since the counting of abstentions is a necessity of STV[^], it follows that the voters conceivably might abstain from providing a quota of votes for even one of the candidates.

A quota of abstentions, leaving one of the seats vacant, can be considered as the election of an anonymous candidate. Therefore, it follows that voters should be allowed to fill in the blank spaces for candidates, on their ballot papers, with unofficial nominations.

All preferences are counted, including abstentions. The return of a blank ballot paper is equivalent to None Of The Above (NOTA) and

gives one whole vote towards the quota for an unfilled seat.

If one of the numbers is omitted from a voters order of choice, that number is treated as an abstention, being for no one in particular, at that stage in the count.

If a number is repeated for two candidates, again being for no particular candidate, that number preference is also treated as an abstention, at that stage.

It remains important that the public are well rehearsed in the use of ranked choice for any STV election. When the single transferable vote was re-introduced to Ulster, in the 1970s, an Ulster Assembly MP complained, on BBC radio, that a constituent came up to him, saying that he gave him all 7 (or whatever) of his votes.

With traditional STV, the number 7 counts as 7th in line of choice, and a ballot paper that doesn't include the earlier orders of choice, would be regarded as invalid and not counted.

The Consultation Paper on electoral reform (Scottish government, december 2017) points out that with electronic voting, the computer can notify the voter of how to amend invalid votes.

Binomial STV gives bidirectional preference.

With STV⁺, it is possible that voters may order their choices for the candidates they least like, as well as most like. For example, if there are 10 candidates, a voter might put the number 10 against some candidate, that he particularly dislikes. And that would help to weigh against that candidates chances of election.

So, if a candidate just put the number 10, on his ballot paper, that should count as a meaningful expression of intention, in that

election, and be a valid vote.

Thus, with STV[^], not only orders of preference, but orders of unpreference, or reverse preferences from least preferred, to next least preferred, and so on, count as valid indications of choice.

The total number of candidates should be prominently shown at the top of the ballot paper, perhaps with a reminder that also allowed, but not necessary, is the expression of reverse order of preference, 10, 9, 8,... etc, as well as order of preference, 1, 2, 3,...etc. The distinction does not arise, if a voter gives an order of preference for all the candidates, in which case, the two orders of preference become one. It is not necessary to express a whole order of preference, and it even is allowed not to express any preference.

Perhaps it should be stressed, that the foregoing level of explanation should be familiar to voters, before they enter the polling booths, so that it is no more than a reminder or prompt, when they get there.

So, binomial STV allows the voters bidirectional preference. This has potential for refined data retrieval. A typical internet search engine allows the searcher to put a plus or a minus sign against a search entry, to show which terms it wants selected and which rejected, as a means of disambiguation, to narrow down the search. For example, you might type the plus sign for STV and minus sign for "Scottish" or "television", to avoid results for STV, as Scottish television. (It rarely seems to work for me but I am not computer savvy.)

Plus or minus is only a single bidirectional preference. Binomial STV offers a multiple bidirectional preference, and so the prospect of far more searching results.

First-order STV (STV¹) procedure.

Unlike traditional STV and Meek method, Binomial STV (STV¹) does not exclude, from contention, the currently least preferred candidate, when elected candidates surplus votes run out. (This has attracted the criticism called “premature exclusion”.)

First-order STV (STV¹) is distinguished from previous official elections, versions of STV included, even Meek method, by having not only an election count, but also an exclusion count, two rational counts, whose results are averaged, to reach a more representative final result than either.

The exclusion count is conducted in exactly the same way, except in reverse order of voters preferences.

The election count is the quota election of the most popular candidates in order of voters preferences. It is conducted like Meek method, with its thoroughgoing transfer of voter surpluses, even by way of candidates already elected, in order to follow the exact paper trail of voters preferences, which normally would be too difficult to count, except thru a computer program.

Unlike Meek method, the STV¹ election quota is not reduced in line with voters ceasing to express preferences. That is because STV¹ counts all preferences including abstentions, which go towards the quota for an unfilled seat.

Previous methods of STV originally used the Hare quota in large constituencies and later the Droop quota, more suited to small constituencies. Fewer seats have higher quotas but the Droop quota threshold is the least demanding. However it is also the least discriminating as to real preference between candidates.

In contrast, the Hare quota is most demanding. My innovation of the Harmonic Mean quota is, as the name suggests, their harmonic mean, their representative average quota.

The Harmonic Mean quota is not ideal for small constituencies but small constituencies are not ideal for democratic representation of more than a small number of view-points.

Therefore the HM quota is recommended for perhaps at least 5 member constituencies. (The Irish Constitutional Convention recommended this 5 seats minimum for its STV constituencies at general elections.)

HM quota = $(\text{votes})/(\text{seats} + \frac{1}{2})$.

Each stage of transferring surplus votes is according to Meek method. Beyond Meek method, the keep values are calculated of all candidates, in deficit, as well as surplus, of a quota. This is according to the Meek formula of keep value plus transfer value equals one. It just means that unelected candidates have negative transfer value (deficit value, instead of surplus value) and their keep value is correspondingly greater than 1.

Having tabulated the election count keep values, and the exclusion count keep values, for each and every candidate, the latter are inverted. The inverse keep values, of unpreference for candidates, serve as an alternative set of preference keep values. The two sets, the preference keep values and the inverse unpreference keep values, can then be averaged, using the geometric mean, giving the final keep values for first order binomial STV (STV¹).

Higher orders of binomial STV.

Traditional STV, including Meek method, may be described as uninomial STV, because there is just one count, namely of preferences, and not also an unpreference count. First-order binomial STV has one preference count and one unpreference count.

The binomial theorem, to the power of 2, has 4 terms in its expansion. So, in terms of preference, P, and unpreference, U, Second order binomial STV has four counts.

The orders of Binomial STV can be generalised, as shown in table 19. The zero order row, representing uninomial STV, is given a conventional assignation in conformity with the succeeding rows of higher orders.

Table 19. Non-commutative binomial theorem expansion logic of ever higher order STV counts

STV order		
0	$(P+0)^0$	P
1	$(P+U)^1$	P+U
2	$(P+U)^2 = (P+U)(P+U)$	PP+PU+UP+UU
3	$(P+U)^3 = (P+U)(P+U)(P+U)$	PPP+PPU+PUP+PUU+ UPP+UPU+UUP+UUU

Table 19 illustrates the logic of ever higher order STV counts. In fact, STV^A is a generalisation or logical extension of the traditional (preference-only) STV count. The logic of the change from a first order count to a second order count, is repeatable for every

successive stage, each stage building on the next. Once you know how the second order is constructed, you know how every next order is decided.

Take order one, which is: $(P+U)$.

To move to order two, simply multiply the previous order by $(P+U)$.

This is the rule for every increase by an order.

Thus:

$(P+U)(P+U)$.

The rules, for expanding these two factors into a binomial series, are as follows. The factor to the right, which is the qualifying factor, alters the terms to the left. Its terms always precede the terms to the left, because it stands for the nature of the redistribution count, with regard to terms on the left, which represent counts that have already taken place.

First we take the P term in the right factor and multiply it by the P term in left factor, and then by the U term in the left factor. Hence, $PP+PU$. This is repeated with right factor, U . Hence, $UP+UU$.

Thus we have the four qualified counts in second order binomial STV. This is how it works. With reference to already counted first order STV, we take the preference count, P , then redistribute all the votes of P for preferred candidates (elected with a quota or more of the votes). Each such redistribution is called a PP count. This is counted in the usual way, til all the surpluses are transfered and resulting keep values calculated. The keep value of each redistribution candidate is retained in that redistribution count (not being altered by the redistribution).

When all the eligible PP redistribution counts are done, their respective keep values are averaged (using the arithmetic mean) for a representative set of PP keep values for the candidates.

This averaged redistributions procedure (for PP redistributions) is repeated for its other three scenarios, PU, UP, UU.

Note that PU and UP are not the same: order of terms is important. PU stands for the preferred (quota-reaching) candidates qualifying for votes redistribution in an Unpreference, U, count.

Whereas UP stands for the Unpreferred candidates, U, (being those who reached a quota of voters disliking them, in a reverse-preference or exclusion count) having their votes redistributed in a preference, P, election count.

Finally, UU stands for each Unpreferred candidate, U, (who reached a quota of unpreference, in the first order exclusion count, U) having their votes redistributed for a thus qualified exclusion count.

Suppose all the second order redistribution counts are in. The stage is then set for a possible third order count, with reference to table 18:

$$(PP+PU+UP+UU)(P+U) = \\ PPP+PPU+PUP+PUU+UPP+UPU+UUP+UUU.$$

Thus, each successive order of count has double the number of classes of count. But to a computer, exponential growth is no problem, provided it has an electronic translation of the logic of the operation.

The term to the right of a composite term always signifies the basic nature of the count. In the case of STV², PP and UP are (qualified) election counts. PU and UU are (qualified) exclusion counts.

When the arithmetic mean keep values, of the classes of redistribution counts are in, then they too are averaged. The geometric mean (GM) of PP and UP classes gives an average count of election keep values. The geometric mean of PU and UU classes gives an average count of exclusion keep values. The latter GM is inverted and multiplied by the former GM, and the square root taken, to give an overall set of (geometric mean) keep values for the candidates, completing the second order binomial STV count. Equivalently, the qualified preference GM is divided by the qualified unpreference GM.

The first and second order final counts can themselves be averaged using a fourth average, introduced by myself, the power harmonic mean. This new average can be extended to any number of orders of Binomial STV counts.

Along with my innovations of the Harmonic Mean quota, the geometric mean of unlike counts and the arithmetic mean of (like) redistribution counts, and my further innovation of the power harmonic mean, that completes Four Averages Binomial Single Transferable Vote (FAB STV).

An Impossibility (theorem) but for Information.

(Supplement 1)

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Five voting systems elect five different candidates.

[Weighted Condorcet pairing.](#)

[STV¹ applied](#) to contrary elections example.

Five voting systems elect five different candidates.

The kind of distribution of preferences in table 1 below was first raised by the eighteenth century French philosophers Condorcet and Jean-Charles de Borda. Such a pattern of preferences among voters shows how different voting methods, to elect a single representative, could each elect a different candidate, A, B, C, D, or E.

First Past The Post elects A.

The Supplementary Vote elects B (by a run-off between the two candidates with the most first preferences).

The Alternative Vote elects C (by successively re-distributing the votes of the candidate, with the least first preferences, to his next preference).

Borda method elects D (by a system of giving one more point for each higher preference).

Condorcet method elects E (as the winner of all one-to-one contests).

The controversy, between Condorcet and Borda, is related in my book, *Peace-making Power-sharing*, in the chapter, *Choice Voting America?* There it is explained why transferable voting for multi-member contests is more powerful than Borda method for single member contests.

Table 1 gives the details of this contrived election. To make the arithmetic much easier, the preference distribution is far more simplified than would be found in a normal case of preferential voting for several candidates.

Table 1: 110 voters
preferences for 5
candidates.

votes	1st	2nd	3rd	4th	5th
36	A	D	E	C	B
24	B	E	D	C	A
20	C	B	E	D	A
18	D	C	E	B	A
8	E	B	D	C	A
4	E	C	D	B	A
110					

Weighted Condorcet pairing.

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Should anyone remark on the five contrary results this example is supposed to generate, let us show otherwise by using a different method of Condorcet pairing than that traditionally used to show E is the Condorcet winner. That is the result of inaccurate method. When Condorcet pairing is properly quantified, the result differs, as table 2 shows.

Looking at table 2, notice that, in any combination, the number of voters where one candidate is preferred to another, and vice versa, the total must always come to the total number of votes: 110 votes. For example: A is preferred to B by 36 votes. And B is preferred to A by 74 votes. B is preferred to C by 32 votes. And C is preferred to B by 78 votes.

Table 2: Geometric mean weighted Condorcet pairings.

< (voters prefer less than below)	>A (voters prefer more than A)	>B	>C	>D	>E	Quota/ (row G.M.): 55/(4th root of 4 row figures)
A		36	36	36	36	$55/36 = 1.528$
B	74		32	52	44	$55/48.246 = 1.14$
C	74	78		24	38	$55/47.9 = 1.148$
D	74	58	86		54	$55/66.817 = .8231$

E	74	66	72	56		55/66.615 = .8256
---	----	----	----	----	--	----------------------

To quantify the amount, by which all the candidates are preferred less than ($<$), any given candidate (in the left-side column of table 2) take the adjacent row of four sets of votes, showing by how many votes, that candidate is preferred more than ($>$) each of the other four candidates. Multiply that row of four sets of votes, and take its fourth root. That obtains the geometric mean vote of preference of one candidate over the four others.

Finally, divide this geometric mean into the quota. In other words, establish what is the ratio of the quota to a candidates level of preferment. This is another way, than Binomial STV, of arriving at a keep value for each candidate.

Traditional Condorcet pairing shows candidate E wins every one-to-one contest and is therefore the Condorcet winner. Averaged Condorcet pairing shows that, in this example, candidate E is overhauled by candidate D, albeit by a tiny margin. But then the example was designed on narrow margins to make possible seemingly contrary results. Actually, D wins all pairings but with E, who only wins by the narrowest possible margin. Traditional (winner-takes-all) Condorcet pairing hides such quantitative margins which can and do distort the result.

In fact, Borda method and this more accurate, weighted Condorcet method agree that D is the winner. The discrepancies of First past the post, the Supplementary Vote, the Alternative Vote and the less quantitative traditional form of Condorcet winner are all due to their imprecise counting methods which discard too much preference information.

Borda method is more quantitative than the other four traditional methods and comes up with the right result here. But even Borda method uses only an estimated weighting of the vote that is no better than a guess, that can be out.

Weighted Condorcet pairing is not the whole picture. Altho it gives a systematic comparison between each candidate, it discards the over-all orders of preferences voters choose for the candidates.

For progress in a count of the over-all orders, we turn to Binomial STV.

STV¹ applied to contrary elections example.

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First order Binomial STV (STV¹) is applied to the example, giving contrary election results from five different voting methods.

Up till now, STV has not been considered applicable to single seat elections. That is because a transferable vote implies at least two seats, so that, when one candidate has enough votes to be elected, a surplus is transferable to help next preferred candidates contest another seat.

Binomial STV over-comes this limitation, thru its keep-value weighting. Condorcet method does not employ the over-all range of preferences, only compares pairs of candidates. Binomial STV with its results for the full range of preferences makes fuller use of the preference information.

Table 3 is the first order election count. No candidates first preferences come close to the quota for one vacancy, $110/(1+1) = 55$

votes.

Table 3. STV¹ election count.

Candid-ates	1st prefs.	keep value
A	36	$55/36 = 1.528$
B	24	$55/24 = 2.292$
C	20	$55/20 = 2.75$
D	18	$55/18 = 3.056$
E	12	$55/12 = 4.583$
Total votes:	110	

In table 4 of the first order exclusion count, one candidate exceeds the unpopularity quota. Candidate A has a surplus of 19 unpopularity votes, which are transferable as a fraction of the total transferable vote of 74 least preferences for candidate A.

Table 4. STV¹ exclusion count.

Candid-ates	Least prefs.	Transfer A surplus @ 19/74	Post-transfer vote	Exclus-ion keep value
A	74	--	55	0.743
B	36	$22 \times 19/74 = 5.649$	41.649	1.321
C		$32 \times 19/74 = 8.216$	8.216	6.694
D		$20 \times 19/74 = 5.135$	5.135	10.711
E				$55/0 = \infty$
votes	110		110	

Table 5 brings the results of tables 3 & 4 together, namely the keep values of the election count and exclusion count, for the combined count, that gives the final keep values for first order binomial STV (STV¹).

Table 5. STV¹ results.

Candid-ates	Election keep value	Exclus-ion keep value	Election/exclusion keep value
A	1.528	0.743	2.057
B	2.292	1.321	1.735
C	2.75	6.694	0.411
D	3.056	10.711	0.285
E	4.583	∞	0

On the basis of keep values, candidates, C, D, and E all warrant election. Only one seat is vacant, for which E is the clear winner. If the voters had exactly reversed preferences, then just candidates A and B would warrant election. A would be the clear winner, instead of the clear loser.

Candidate D comes a good second. This renews the controversy whether D or E is the "real" winner. The truth of the matter is that elections are a statistic, subject to statistical significance of margins between winning and losing. The dogma of the real winner must be abandoned.

Having said that, the previous joint verdict, for D, of weighted Condorcet and Borda was not wrong, given the superior information

they drew on, compared to the three information-poor methods.

There is a difference again with first order Binomial STV (STV¹) which draws on a surrogate rational count, to act like a second opinion, modifying the first. This supplies, on average, potentially more representative information.

To speak more plainly, STV¹ measures the amount by which candidate E is the least unpopular candidate, bringing in data not previously drawn upon. This is enough to swing the result from D to E.

It is true that different voting methods produce different results. That is why the methods that elect incumbents are so coveted by them. When you think about it, the demonstration of 5 or 6 results from 5 or 6 methods, is the most commonplace observation. You only have to see the usual futility of electoral reform, against career politicians proliferating their own rules.

It is false that difference of results justifies difference of voting methods employed. The assertion, that one voting method is as good as another, some way or other, is false. For, the difference in results is a function of the difference in information efficiency of the voting methods used.

Note: I used the infinity symbol, ∞ , in the STV¹ count table, for the sake of form. In large scale elections, you never see results where a candidate receives no votes, and thereby would have an infinite keep value, when the quota is divided by zero votes.

In small scale elections, the candidates could be allowed to vote for themselves, ensuring that the keep value is no more than the quota divided by one vote.

Source for the example:

John Allen Paulos: Beyond Numeracy. (Entry on voting methods.)

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Binomial STV is "monotonic."

(Supplement 2)

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Criticisms and reform of STV.

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Criticisms and reform of STV.

By the single transferable vote (STV or "choice voting"), candidates are each elected on winning a quota of the votes in a multi-member constituency. Some candidates win more votes than they need. These surplus votes are transferable to an elected candidates voters next preferences, by a method called the Senatorial Rules (alias method Gregory). All that elected candidates voters next preferences are taken into account but they can only be valued or weighted in proportion to the size of the surplus. This fractional weighting or

value, at which surplus votes are transferred, is called the "transfer value".

The elected candidate only keeps the number of votes needed to be elected, that is the quota. The ratio, of the quota to all this candidate's votes, is the fraction of his votes that the candidate keeps. It is called the "keep value."

An elected candidate's keep value and transfer value are fractions that always add up to one. This is because all a candidate's voters must always have a vote, whose value adds up to no more and no less than one. This follows the democratic principle of one person one vote. All that varies is the proportion of the vote that goes to a first or second preference, and possibly further preferences.

However, at some stage in the STV count, there may be no more surplus votes to transfer, before all the seats in the multi-member constituency have been filled, by sufficient candidates achieving a quota. Then, the least likely candidate, to be elected, has to be excluded, to provide more votes to re-distribute to that candidate's voters next preferences.

At this stage, traditional STV excludes the candidate with the least votes. Meek method does likewise. The difference between the traditional manual count of STV and Meek computer count of STV is that Meek can be much more systematic in using the senatorial rules to count the value of every next preference. The traditional count typically has to take short-cuts to make a manual count manageable. Hopefully, these short-cuts don't often make much or any difference to the more strictly accurate count usually only practical with a computer.

Thus, manual count and Meek method differ in election of candidates. But they do not differ in the exclusion of candidates.

Both essentially use the reverse of a First Past The Post, or "simple majority" system to elect candidates. That is a "Last Past The Post" or "simple minority" system to exclude a candidate, who happens to have the least votes, once the election surpluses have run out.

In other words, a remnant of the old way of thinking has got left in the exclusion part of the count, known as proportional representation by the single transferable vote. This is ironic, because much of the academic criticism of PR by STV has come from censure of the effects of its last-past-the-post exclusion method.

For instance, Riker example below, to expose the perversity ("non-monotonicity") of STV, supposed an STV election with no surplus of first preferences to transfer. This means an STV election that has to start with an exclusion. Such critics have discredited Last Past The Post exclusion, to try to discredit STV, as an election, in favor of a First Past The Post election system (on its own or as part of a mixed system with party lists).

The critics of STV have not put the blame for perverse results where it belongs, in the simple plurality system (whether simple majority election or simple minority exclusion). They have just focused on faults, apparent to a minor extent in STV exclusion procedure, to excuse the same faults, apparent to a major extent in First Past The Post elections.

In the middle of the nineteenth century, within six months of the appearance of the Hare system (the original STV), John Stuart Mill noted this habit of critics to project or throw the faults of the simple majority system onto proportional representation.

Using proportional representation in the exclusion count as well as the election count, makes STV consistently a system of PR. That is to say when PR by STV can take the count no further in the election of candidates, then PR is used in the exclusion of candidates.

The exclusion count takes every order of preference, chosen by voters on their ballot papers, in reverse. Starting with the last preferences, a candidates votes are added till they reach a quota, as a measure of exclusion. The exclusion count is conducted in the same way as the election count. When one realises that a count consists of a method of election and a method of exclusion, and that a method of exclusion is the reverse application of a method of election, it should no longer seem strange or controversial that one use the best available method for both election and exclusion.

The reason for using transferable voting to elect candidates also justifies its use to exclude candidates. STV is pre-eminent as a voting system because it uniquely follows the four scales of measurement, analysed by SS Stevens, and widely recognised in the sciences, in relation to problems of research. (Measurement scales and voting methods are discussed in my book: Scientific Method Of Elections.)

An exclusion quota brings the STV exclusion count up to the most powerful scale of measurement, the ratio scale. Likewise, the rational use of keep values for candidates in deficit as well as in surplus of a quota allows systematic re-counts, such as based on the binomial theorem, to derive average keep values, which may be more representative of the voters choice than a single count.

AV and STV methods of excluding candidates.

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The simplest of elections can also be regarded as an exclusion. When two candidates contest a single office, the candidate with more votes is elected. One can also say that the candidate with less votes is excluded. I have described the single transferable vote as a

generalisation of the simplest method of election from a single preference vote for a single majority count to a many-preference vote for a many-majority count.

The count of STV for election of candidates and for exclusion of candidates has not been developed in a balanced or complementary manner. The transferable vote is of surpluses from candidates elected with more than enough of the required proportion or quota of votes in the constituency.

No such rule has applied for the exclusion, as distinct from election, of candidates in STV elections. Instead, STV has used the same method of exclusion used with the Alternative Vote (AV).

This matters, because far-out critics have argued against STV ever being used, simply for this employment of the AV exclusion or elimination count. This is not balanced criticism, as I tried to explain, against the Plant report. This Labour party committee didn't even consider STV as an option in its final report. This was all the more absurd in that the report recommended the Supplementary Vote, which is a limited form of the Alternative Vote.

The Alternative Vote is meant to elect the candidate with an over-all majority of votes in a single member constituency. If no one candidate has half or more of the first choice votes, then the candidate with the least first preferences is excluded. The excluded candidates voters then have their votes re-distributed according to their second preferences. This process of elimination and redistribution is repeated till a candidate wins a majority.

This is what the STV count has resorted-to when there are no more surplus votes to transfer to help elect more candidates to the quota. However, STV is in multi-member constituencies. There is more than one seat to be won. The re-distributed votes of some excluded

candidates may be more than enough to elect a further candidate. In that case, another elected candidates surplus vote becomes available to help elect next preferred candidates.

The Supplementary Vote is a truncated version of the Alternative Vote. The two candidates with the most first preferences are the only ones not excluded in the first round. Voters for the excluded candidates then have their supplementary vote (a second X-vote) counted, if it is for one of the two remaining candidates. In short, the Plant report chose a voting method that used a method they considered enough to disqualify STV for only partially using!

Sequential STV.

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Sequential STV was devised to prevent the premature exclusion of candidates thru its last past the post exclusion method, by adapting the method of Condorcet.

The Condorcet method elects the candidate who comes off best in paired contests between all the candidates. J F S Ross did not recommend Condorcet pairings, because they neglect that higher preferences are more important than lower ones. Whereas the Senatorial Rules of transferable voting use a method called (in simple statistics) "weighting in arithmetic proportion" that gives due weight to the rank or order of choice.

However, Sequential STV systematically re-runs a conventional STV election with the winners pitted in turn against just one of the candidates not elected. The re-runs all involve just one more

candidate than seat, so there is no need, in each of these sub-contests, to exclude a candidate before all the seats can be filled.

If the winners are the same as in the original contest, the election is over. But a new winner, replacing one of the old in the sub-contests, features thru-out another systematic series or sequences of sub-contests. Basicly, this goes on, till the situation either stabilises into consistent winners of the given number of seats, or a cycle appears, like a Condorcet cycle, which announces a dead-lock.

The sequence of sub-contests, that may throw up other winners than by simple STV, are rational in themselves. But their results compared to each other need not represent victories of the equal weight, that they are implicitly given. So, essentially, Ross objecting about proper weighting, applies against Sequential STV

The moral of all this is to make the most rational measures when possible rather than just measures of more or less, which are less accurate for comparisons of results. The more approximate the scale of measurement the more room for errors. Identifiable patterns of error then become enshrined as paradoxes. Sequential STV conceivably can cause a voters prior choice to lose an election, if the voter adds a second preference.

In other words, as the devisor of Sequential STV admits, it is still what the social choice theorists call "non-monotonic".

From a scientific point of view, Sequential STV has the merit that its process of elimination resembles a controlled experiment. But it seems to have the theoretical weakness of being ad hoc. The system has been devised solely for the purpose of preventing premature exclusion, without being inherent in simple STV.

Non-monotonic exclusion of candidates.

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It is worth looking at the exact criticism cited by second interim Plant report, appendix one. (Afterwards, their example may be used to show how the innovation of keep-value averaged STV can overcome the objection described.)

The report quotes Riker (*Liberalism Against Populism*) that STV is not monotonic:

"By monotonicity is meant that if one or more voters change preferences in a direction favourable to x then the resulting change, if any, should be an improvement for x."

Riker gives an example of how STV can break the monotonic rule. Suppose four candidates compete for 26 votes to win two seats. The votes each winner needs is given by $26/(2+1)$, which is 9 rounded-up to the nearest whole number.

A first version of the voters preferences is given in situation one. A second version differs only in that two voters have swapped their first and second preferences from first Y, second X, to first X, second Y. But this improved support for X, in the second situation, loses X the seat X wins in the first situation.

The perversity of this changed result is an example of a "non-monotonic" counting procedure. (See tables, situation 1 and situation 2.)

Table 1. Situation 1:
voters orders of
choice

votes	1st	2nd	3rd	4th
-------	-----	-----	-----	-----

9	W	Z	X	Y
6	X	Y	Z	W
2	Y	X	Z	W
4	Y	Z	X	W
5	Z	X	Y	W

Table 2. Situation 2:
voters orders of
choice

votes	1st	2nd	3rd	4th
9	W	Z	X	Y
6	X	Y	Z	W
2	X	Y	Z	W
4	Y	Z	X	W
5	Z	X	Y	W

As I mentioned at the time of the Plant report, this example of the transferable vote does not include its distinctive feature of transferable voting. Riker has given an example in which no candidates win more votes than they need on first preferences alone. So, the example has no surplus votes to transfer.

The tables of preferences could be turned. The fourth choices could be first, the third choices could be second, etc. In that case, the two seats would be won in the first round. W would win with a large surplus. There would not even be any need to transfer this surplus to next choices, because Y, too, would be elected on just enough votes, the quota of 9.

This turn-about may not seem relevant to Riker example. But it is, if transferable voting is used not only to elect candidates but to exclude them. (This example is similar to the Paulos election in the previous chapter: the, at first, most preferred candidate, A, is also an even more, at last, unpreferred candidate.)

First order Binomial STV (STV¹) count of critics example.

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Starting with the first order count of Riker Situation 1, we see whether the contrived example can be given a clear result with this new version of STV and whether it is non-monotonic, like conventional STV.

Table 3. situation 1. STV¹
election count.

Candid-ates.	1st prefs.	keep values.
W	9	$9/9 = 1$
X	6	$9/6 = 1.5$
Y	6	$9/6 = 1.5$
Z	5	$9/5 = 1.8$
votes:	26	

Table 4. Situation 1: STV¹ exclusion count.

Candid-ates	Last prefs.	keep value	W surplus transfer @8/17	post-transfer keep value
W	17	9/17	9	0.529
X			$4 \times 8/17 = 1.882$	4.782
Y	9	1	$9 + (5 \times 8/17) = 11.353$	0.793
Z			$8 \times 8/17 = 3.765$	2.390
votes	26		26	

Table 5. Situation 1: STV¹ final keep values.

Candid-ates	Election keep value	Exclusion keep value	1st order STV (Elect./Exclus.) keep value
W	1	0.529	1.890
X	1.5	4.782	0.314
Y	1.5	0.793	1.892
Z	1.8	2.390	0.753

First order binomial STV shows that candidates X and Z are elected to the two available seats, with keep values of less than one.

We now modify situation 1 to situation 2, in table 6. And show the effect on the result in table 7. First order binomial STV clearly shows that the advantage given to candidate X does not have the perverse ("non-monotonic") effect of traditional (uninominal) STV. On the contrary, the gain to candidate X and loss to candidate Y is reflected in their changed keep values.

Table 6. situation 2. STV¹
election count.

Candid-ates.	1st prefs.	keep values.
W	9	$9/9 = 1$
X	8	$9/8 = 1.125$
Y	4	$9/4 = 2.25$
Z	5	$9/5 = 1.8$
votes:	26	

Table 7. Situation 2: STV¹ final keep values.

Candid-ates	Election keep value	Exclusion keep value	1st order STV (Elect./Exclus.) keep value
W	1	0.529	1.890
X	1.125	4.782	0.235
Y	2.25	0.793	2.837
Z	1.8	2.390	0.753

The first order STV result is so clear-cut, for the Riker change from Situation 1 to Situation 2, that there is no need to labor the obvious, by doing a second order STV count, in this scenario.

Binomial STV is rendered consistent by introducing a rational exclusion count of keep values to replace the theoretical possibility (if practical improbability) of residual irregularities from resort to a Last Past The Post expedient.

Finally, on a personal note, I try to be a little more gracious towards critics than they have been towards conventional STV method. It is true that mote-in-your-eye critics of STV have exaggerated the molehill of failings from residual plurality counting in STV, while remaining remarkably oblivious of the mountain of plurality counting failings from non-transferable voting systems.

Nevertheless, their carping and crying wolf, provoked me to make the serious effort to rid STV of the premature exclusion of candidates, and inaugurate the splendid model of Binomial STV.

Reference:

I D Hill. Sequential STV. *Voting Matters*- Issue 2, Sept. 1994.

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Supplement 3: One Average Binomial STV.

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Voters preferences or, conversely, unpreferences.

[First](#) order Binomial STV (STV¹) count.

[Second](#) order Binomial STV (STV²) count.

[Traditional](#) STV (STV⁰) version of above example.

[Foot-note](#) on keep value of candidates without votes.

Voters preferences or, conversely, unpreferences.

The following example repeats the actual contest that took place between 21 candidates for 5 seats. This time, only one of the four averages, in FAB STV, is used, the geometric mean, which is the one average necessary to make Binomial STV possible.

I even have not used my own Harmonic Mean quota, the average of Hare and Droop quotas. Instead, I have used the Droop quota, the STV quota, that has superseded the Hare quota, in modern times.

My Binomial STV change in quota level (from HM to Droop) only lowers the bar of election for all candidates. It does not alter the relative positions of the candidates. With conventional STV, altering the quota level alters when the surplus votes run out, possibly to exclude or eliminate a different candidate, who has least votes at that stage, for transfer to his voters distinct next preferences.

(In the jargon of election method mathematics, Binomial STV is monotonic, but conventional STV is non-monotonic.)

There are only 10 voters, from which one could not infer much of a voting pattern. The count of such a small number is mostly useful as an exercise in a new procedure. The 10 voters all expressed different permutations of choice for all 21 candidates. There are factorial twenty-one possible permutations of choice, which is a big number! Had even two voters shared the same order of 21 choices, one would suspect that they had agreed a common slate, before casting their preference votes.

Table 1 shows the 10 voters orders of 21 choices. The order of choice reads from left to right. For instance, in permutation row 1, the first choice is A, second choice K, and so on, till the last choice, number 21, which is H. All 10 voters express this on their ballot papers, by numbering their orders of choice from 1, 2, 3, ... to 21.

The count by Binomial Single Transferable Vote also makes use of the reverse order of choices, reading right to left, from last preference to next last, 21, 20, 19, ...

Conventional STV, needing but a single election table (as shown in the section at the end), is simpler than Binomial STV (STV[^]). Even STV[^]1 uses both an election (of preferences) table and an exclusion (of unpreferences) table. But STV[^] makes more use of the voters

preferential information, given in table 1, and therefore has more pretensions to accuracy.

I repeat, larger numbers of voters, than the below example, are really needed to draw realistic conclusions about voters preferences for candidates. Very small numbers of voters tend not to have any significant pattern of distribution, which a highly rational system of election like STV, and even more so, STV[^], depends on, to ensure large proportions of the vote are transferable, for a clear-cut result.

Binomial STV starts like conventional STV with an election quota and the transfer of surplus votes over the quota to help elect next preferred candidates. When this source of election runs out, conventional STV merely excludes the candidate, unfortunate enough to be currently last past the post.

The numbers 1 to 10 in the first column of table 1 have nothing to do with the voters order of choice. They are there for the benefit of the returning officer, in a manual count, to show which number permutation row directs any transfer of votes.

Binomial STV table 1: 10 voters permutations on 21 candidates.

1	A	K	E	B	R	F	L	I	N	P	T	Q	J	M	O	D	C	S	U	G	H
2	B	E	R	A	O	C	N	F	I	P	L	D	K	Q	G	S	T	U	J	H	M
3	O	G	F	S	C	M	A	K	B	T	L	R	E	H	P	J	D	I	N	U	Q
4	G	K	D	M	P	R	Q	A	F	H	L	N	S	U	B	I	C	J	O	T	E
5	H	I	B	Q	E	O	M	F	R	A	K	N	P	C	L	U	S	T	D	J	G
6	A	F	G	I	M	T	C	E	H	K	U	D	N	O	P	Q	B	L	J	R	S
7	O	M	H	P	B	K	A	N	Q	I	C	J	F	L	R	S	U	T	D	E	G
8	L	G	F	O	A	C	M	J	E	N	S	K	R	D	Q	P	B	I	T	H	U
9	K	H	B	J	A	T	I	E	O	N	C	D	L	M	R	Q	G	U	P	S	F

10	K	B	E	T	N	I	A	H	C	M	F	P	R	U	J	L	G	D	O	Q	S
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First order Binomial STV (STV¹) example.

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We start with a first order Binomial STV (STV¹) count, which consists of an election count and an exclusion count. These counts are expressed in keep values assigned the candidates. The exclusion keep values are inverted to make them effective election keep values. These can then be multiplied by the election keep values, which when their square roots are taken, produce average elective keep values for the candidates, determining the winners. (There are different kinds of average to best represent different distributions of data and the average used here is called the geometric mean.)

(If the first order binomial STV count is not completely decisive, it may be necessary to embark on a second order binomial count.)

The returning officer starts (a just about doable) manual count of first order Binomial STV (STV¹) by counting the number of votes and counting the number of first preferences, shown in the first column of letters for candidates, on the left of table 1. Three candidates, A, K, O each have 2 votes, which are enough to elect them, being over the elective quota of $10/(5 + 1) = 1.667$ votes (to three decimal places).

The surplus vote is transferred at a transfer value of: $(2-1.667)/2 = 0.167$ to three decimal places, according to the next preferences of the six voters, who gave two votes each to A, K and O. In this case,

all six second preference candidates each receive 0.167 of a vote. This is recorded in table 2, col. 2.

For reference, the returning officer keeps track of these transfers by noting the number of each permutation row in which a next preference gains a surplus vote. So, the six transfers of 0.167 votes are as follows. On permutation row one (perm 1) elected candidate A, has already elected K for second preference, so the surplus transfers to third preference, E. But the fact that K was the second preference of that voter is important, because it increases the size of Ks transferable vote from 2 to 2.167 votes. This improves Ks keep value, which is the quota divided by Ks total transferable vote, to $1.667/2.167$.

A candidate, whose transferable vote is the same as the quota has a keep value of 1, which means the candidate is just elected with no surplus vote to spare. The larger a candidates transferable vote than the quota, the smaller the keep value. In this election, K has the smallest elective keep value, which means the best elected candidate.

(As it happens, the exclusion count does not modify this result: K stays in the lead for the over-all result.)

The other vote transfers are: On perm 6, A to F. On perm 9, K to H. On perm 10, K to B. On perm 3, O to G. On perm 7, O to M. The numbers of votes for the candidates, after these transfers, is recorded in table 2, column 2.

In column 3, as there are no more votes to transfer, the keep values are calculated from the quota divided by the highest votes each candidate received. Three candidates, with keep values, of one or less, are elected out of the five vacancies. But an exclusion vote, significantly higher than the quota, might be enough to unelect a candidate.

Table 2: STV¹ Election count. Quota
 $= 10/(5+1) = 1.667$.

Candid-ates	1st prefs.	A, K, O, elected. Surplus transfer @ 0.167.	Preference keep value.
A	2	1.667	$1.667/2 = 0.833$
B	1	1.167	$1.667/1.167 = 1.428$
C			
D			
E		0.167	$1.667/.167 = 9.982$
F		0.167	$1.667/0.167 = 9.982$
G	1	1.167	$1.667/1.167 = 1.428$
H	1	1.167	$1.667/1.167 = 1.428$
I			
J			
K	2	1.667	$1.667/2.167 = 0.769$
L	1	1	$1.667/1 = 1.667$
M		0.167	$1.667/0.167 = 9.982$
N			
O	2	1.667	$1.667/2$

			= 0.833
P			
Q			
R			
S			
T			
U			
votes	10	10	

Table 3, for the exclusion count, follows table 1 from right to left, for next least preferred candidates. Candidates S and G, each with 2 last preferences, are over the exclusion quota, which (like the election quota) is 1.667. S and G surpluses of last preference are transferred to next least preferred candidates. The transfer values happen to be again 0.167. Hence, on perm 6, S transfers to R. On perm 10, S transfers to Q. On perm 5, G transfers to J. On perm 7, G transfers to E.

But no further candidate reaches an exclusion quota. Then, the exclusion keep values are calculated.

Table 3. STV¹Exclusion count. Quota = 1.667.

Candidates	Last prefs.	S & G surplus transfer @ 0.167	Unpreference keep value
A			
B			
C			

D			
E	1	1.167	$1.667/1.167$ = 1.428
F	1	1	$1.667/1$ = 1.667
G	2	1.667	$1.667/2$ = 0.833
H	1	1	$1.667/1$ = 1.667
I			
J		0.167	$1.667/.167$ = 9.982
K			
L			
M	1	1	$1.667/1$ = 1.667
N			
O			
P			
Q	1	1.167	$1.667/1.167$ = 1.428
R		0.167	$1.667/.167$ = 9.982
S	2	1.667	$1.667/2$ = 0.833
T			
U	1	1	$1.667/1$ = 1.667
Total:	10	10	

The keep values from the election table 2 and the exclusion table 3 are now combined in table 4 for the over-all keep values of the candidates. These are calculated by multiplying the elective keep values by the inverted exclusion keep values. The inversion of the exclusion keep values makes them effectively elective keep values. Then multiplying the two sets of values and taking their square roots produces (geometric mean) average keep values, which aim to be more representative of the candidates support.

Table 4: STV¹ Over-all keep values.

(0) Candid-ates.	(1) Elective keep value	(2) Exclusive keep value inverted	Over-all keep value: $\sqrt{\{(1) \times (2)\}}$
A	0.833		
B	1.428		
C			
D			
E	9.982	$1/(1.428)$ = 0.7	2.643
F	9.982	$1/1.667$	2.447
G	1.428	$1/(0.833)$ = 1.2	1.309
H	1.428	$1/1.667$	0.926
I			
J			
K	0.769		
L	1.667		
M	9.982		

N			
O	0.833		
P			
Q			
R			
S			
T			
U			

The over-all keep values from table 4 show K as the most preferred candidate, with A and O also elected. Candidate G reached an exclusion quota with a slight surplus. When this was inverted for an effective elective quota of 1.2, this was enough to increase G's over-all elective keep value from the elective keep value. This meant that candidates H and B with the same elective keep values as G, do slightly better over-all, as H unpreference was small enough to help effectively elect him. Whereas B had no unpreference and, therefore must be presumed to have some elective keep value better than H or G.

H and B qualify for the two remaining vacancies out of five. Not far behind, candidate G.

Having described the first order Binomial STV procedure, the results must be taken with caution, especially for a statistical interpretation of a mere 10 votes. Statistics measures averages of distributions and the variations from the average in the distribution. But to fill out a distribution such as the binomial distribution would require at least 30 voters.

Second order Binomial STV (STV²) count

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The second order Binomial STV count is more complicated than the first order count. The first order count, as we have seen above, merely does a quota count of transferably voted preferences. Then another count of transferably voted unpreferences, the exclusion count takes table 1 preferences in reverse order (from right to left).

The second order count involves not two but four counts. The former two counts of the first order are both qualified in two ways, to make these four counts. The count of preferences has the votes of the most preferred candidate, reaching the election quota, re-distributed. I call this a preference-qualified preference count (symbolised pp). Likewise, the count of unpreferences can have the votes of the most unpreferred candidate, reaching the exclusion quota, redistributed. This is the unpreference-qualified unpreference count (symbolised uu).

Moreover, another count can be run with the most preferred (quota-achieving) candidates least preferences re-distributed to their next least preferences, to qualify an unpreference count. That is a preference-qualified unpreference count (symbolised pu). Conversely, a count can be run with the least preferred (quota-achieving) candidates greatest preferences re-distributed to their next greatest preferences, to qualify a preference count. This is an unpreference-qualified preference count (symbolised up).

The four symbols, pp + up + pu + uu, constitute a second order (non-commutative) binomial expansion of p plus u. "Second order" means here its square: $(p + u)^2$. And "non-commutative" means that the count tables for "up" and "pu" are not the same. (So the expansion terms, 2pu or 2up, would be wrong in this context.)

The first order binomial STV is simply a preference count plus an unpreference count or $(p + u) = (p+u)^1$.

Commencing the second order count, with the preference-qualified preference count: From table 2 of the preference count, table 5 below re-distributes the votes of the most preferred candidate, who is K, with the lowest election keep value.

[Note: This early version of Binomial STV here left out redistributing the votes of all candidates surpassing the quota; finding the qualified keep values for each redistribution, then calculating one set of arithmetic mean keep values. In this supplement, the keep values are found after redistributing only the votes of the candidate with the biggest surplus.

The arithmetic mean is the second of the four averages in FAB STV, calculated in Part two, but not included here.]

With reference to table 1, K voters two second preferences give candidates H (perm 9) and B (perm 10) an extra vote each. They are both elected with a surplus of 0.333 or one-third of a vote.

In both cases (perms 2 and 10) B voters next preference is E, who gets all the 0.333 surplus of B.

Candidate H voters next preferences go to I (from one vote for H in perm 5) and to B (from one vote K passes-on in perm 9). Thus I and B receive 1 vote each from H: 2 transferable votes, whose surplus transfer value is 0.333. In short, I and B share $1/2$ of 0.333 surplus, or about 0.167 each.

B is already elected and passes on the 0.167 to J (perm 9). But B keep value improves to $1.667/2.167$.

The candidates benefiting from the re-distribution of K votes have their keep values correspondingly improved.

Table 5. STV² preference-qualified preference count (pp). Quota = 1.667.

Candid-ates	K votes re-distribn.	A, K, O, elected. Surplus transfer @ 0.167. H, B elected. Surplus transfer @ 0.333.	pp keep value.
A	2	1.667	$1.667/2 = 0.833$
B	1+1 = 2	1.667	$1.667/2.167 = 0.769$
C			
D			
E		$0.167 + 0.333 = 0.5$	$1.667/.5 = 3.333$
F		0.167	$1.667/.167 = 9.982$
G	1	1.167	$1.667/1.167 = 1.428$
H	1+1 = 2	1.667	$1.667/2 = 0.833$
I		0.167	$1.667/.167 = 9.982.$
J		0.167	$1.667/.167 = 9.982.$
K	--	--	$1.667/2.167 = 0.769$

L	1	1	$1.667/1$ $= 1.667$
M		0.167	$1.667/0.167$ $= 9.982$
N			
O	2	1.667	$1.667/2$ $= 0.833$
P			
Q			
R			
S			
T			
U			
votes	10	10	

It is convenient now to move to a preference-qualified unpreference count, table 6. This is based on the unpreference table 3. This time, the most preferred candidate K is excluded to have his least preferences re-distributed. But K has no least preferences. (Indeed, only one voter has unpreferred K by the ninth least preference.) Therefore, there is a zero transfer of least preference votes from K, who contributes no preference-qualification of the unpreference count. In effect, table 6, the preference-qualified unpreference (pu) count is unchanged from table 3, the unpreference (u) count: For table 6, see table 3.

For table 7, we unpreference-qualify unpreference table 3. Only two candidates have election keep values, as well as exclusion keep values. But this may not remain the case even with only 10 votes to go round 21 candidates. For large scale elections, most probably all

candidates would have election and exclusion keep values -- or, more accurately, preference and unpreference keep values, since not all candidates keep values will signify that they have reached a quota of election or exclusion.

The most unpreferred candidate has the lowest unpreference keep value. That is two candidates, S and G both at 0.833, which being below one, signify exclusions.

Before I thought of taking an arithmetic mean of results from redistributing the votes of both candidates (as in FAB STV), a choice had to be made between S and G. Altho they are equally unpreferred, G is more preferred with an elective 2 first preferences to none for S. This may be a less arbitrary reason for choosing S, than a random choice.

Very close decisions of this sort might have an unwarranted influence on an election result. But an averaging of counts, as with FAB STV, may reduce the effect of any anomaly that occurs in a single count.

Two votes go from S, to R and Q, as next least preferred, respectively permutation rows 6 and 10 in table 1. Thus Q, with 2 votes, passes the exclusion quota, of 1.667, and a surplus of 0.333 goes half to U (perm 3) and O (perm 10).

Table 7 column 3 shows the unpreference-qualified unpreference keep values as a result of the K re-distribution of votes.

Table 7. STV² unpreference-qualified unpreference (uu) count. Exclusion Quota = 1.667.

Candid-ates	S re-distribn.	Q surplus transfer	uu keep value.
-------------	----------------	--------------------	----------------

	G surplus transfers @ 0.167.	@ 0.167 each.	
A			
B			
C			
D			
E	$1 + 0.167$ $= 1.167$	1.167	$1.667/1.167$ $= 1.428$
F	1	1	$1.667/1$ $= 1.667$
G	$2 - 0.333$ $= 1.667$	1.667	$1.667/2$ $= 0.833$
H	1	1	$1.667/1$ $= 1.667$
I			
J	+ 0.167	0.167	$1.667/0.167$ $= 9.982$
K			
L			
M	1	1	$1.667/1$ $= 1.667$
N			
O		0.167	$1.667/.167$ $= 9.982$
P			
Q	$1 + 1 = 2$	1.667	$1.667/2$ $= 0.833$
R	+ 1	1	$1.667/1$ $= 1.667$
S	--	--	$1.667/2$ $= 0.833$

T			
U	1	1.167	$1.667/1.167 = 1.428$
Total:	10	10	

Table 8 is the unpreference-qualified preference (up) count. We redistribute the highest preferences of least preferred candidate S. But S has none. And so table 8 is the same as table 2.

[Even had we chosen G as least preferred, there would have been little change: In table 1, perm 4, there is one first preference for G, which would go to K as the second preference. K is already elected, indeed, the most preferred candidate but this transfer would serve to further improve Ks leading elective keep value. Ks (up) keep value would be $1.667/(2.167 + 1) = 1.667/ 3.167 = 0.526$. As K would not need this further surplus from G, the vote would be passed on to D, who is not otherwise in contention. D would have (up) keep value of $1.667/1 = 1.667$.]

Now we have got all the keep values we need to average them for a second order binomial STV count. In table 8, the pp and up keep values are multiplied because they are both (qualified) preference keep values. The square root of the multiple is taken to derive its average (called the geometric mean). The uu and pu keep values are multiplied because they are both (qualified) unpreference keep values. (It just happens with this very small number of 10 voters, that the preference-qualification is nil on the unpreference count.) The multiple, of the qualified unpreference keep values, also has its square root taken, and is then inverted to make it effectively elective, instead of exclusive.

The two square-rooted multiples are in turn made a multiple, of each other, after the average unpreference count is inverted, and their square root taken, to derive the average of the two averages. This gives the over-all keep values, as shown in the last column of table 9.

Table 9: STV² over-all keep values.

(0) Can- did- ates	(1) pp (table 5)	(2) up (table 8=2.)	(3) Sq. root of (pp x up)	(4) uu (table 6)	(5) pu (table 5=2)	(6) Sq. root of (uu x pu)	(7) Invert col. 6.	(8) Final keep value: Sq. root of (3)x(7)
A	0.833	0.833	0.833					
B	0.769	1.428	1.048					
C								
D								
E	3.333	9.982	5.768	1.428	1.428	1.428	0.7	4.038
F	9.982	9.982	9.982	1.667	1.667	1.667	0.6	2.447
G	1.428	1.428	1.428	0.833	0.833	0.833	1.2	1.309
H	0.833	1.428	1.091	1.667	1.667	1.667	0.6	0.809
I	9.982							
J	9.982			9.982	9.982	9.982	.1	
K	0.769	0.769	0.769					
L	1.667							
M	9.982	9.982	9.982	1.667	1.667	1.667	0.6	2.447
N								
O	0.833	0.833	0.833	9.982				
P								
Q				0.833	1.428	1.091	0.917	

R				1.667	9.982	4.079	0.245	
S				0.833	0.833	0.833	1.2	
T								
U				1.428	1.667	1.543	0.648	

The problem with table 9 is that 10 voters for 21 candidates cannot furnish data for all the candidates to have keep values in all the counts. Normally, there are more voters than candidates and this deficiency shouldn't be a problem. But here we have to take the peculiar circumstances into account to show a reasonable result.

We note at the top of the table, candidate A has an elective keep value of 0.833. But A registers no unpreference. That means the exclusion keep value is 1.667 divided by an indefinitely small number approaching zero. That equals some large number for A's unpreference keep value. Invert that for an effective election keep value and you have an indefinitely small number. This tiny fraction multiplied by 0.833 would only serve to diminish over-all elective keep value of A, to indefinitely less than 0.833. Therefore, we can say that no evidence of an exclusive keep value serves rather to confirm A is elected.

The same reasoning can be applied to candidate B with a more interesting result. For, B's elective keep value of 1.048 is not quite below the elective keep value of 1. But given an indefinitely large exclusion keep value, which means an indefinitely small fraction for the effectively elective keep value, it can be confidently stated that B has an over-all elective keep value of less than one, and is therefore elected.

K has the lowest elective keep value and with some indefinitely small effectively elective keep value is the over-all most preferred candidate.

All the (finite) keep value data is available for H, who is elected on an over-all keep value of 0.809.

Candidate O has an elective keep value of 0.833. The partial data on exclusion quotas indicates that the effectively elective quota would strengthen O as an elected candidate.

Therefore, candidates K, A, O, B and H are elected by second order binomial STV, confirming the slightly less decisive result of the first order count, which candidate G might have called in question.

The traditional STV manual count, given in the last section, would have elected G rather than H or B. The difference in result is perfectly reasonable. It simply boils down to the fact that Binomial STV takes into account unpreference as well as preference. And G, tho quite well preferred, was more unpreferred.

Traditional STV version of above example.

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Table 10 shows how a traditional count of the single transferable vote would typically take place, ignoring slight variations in the rules over the years and over the globe.

Table 10: STV election. Quota =
 $10/(5+1) = 1.667$.

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Can -did -ate	(1) First prefs. Elect A, K, O.	(2) Trans -fer sur- plus of A, K, O all @ 0.166	(3) Excl -ude C, D, I, J, N, P, Q, R, S, T, U; E, F, M.	(4) Excl -ude L. Elect G.	(5) G sur- plus trans -fer @ 0.285
A	2	1.667	1.667	1.667	1.667
B	1	1.166	1.333	1.333	1.665
C			0		
D			0		
E		0.166	0		
F		0.166	0		
G	1	1.166	1.333	2.333	1.667
H	1	1.166	1.333	1.333	1.665
I			0		
J			0		
K	2	1.667	1.667	1.667	1.667
L	1	1	1	0	
M		.166	0		
N			0		
O	2	1.667	1.667	1.667	1.667
P			0		
Q			0		
R			0		
S			0		
T			0		
U			0		

Votes	10	10	10	10	9.998
-------	----	----	----	----	-------

The conventional STV election table shows A, K, O and G elected, with a tie. B or H, would have to be elected randomly to the fifth vacancy. I'm told that using a computer count by Meek's method on this example, H beats B. I was also told by the same expert that candidates A, K, O, G, H always win against any other candidate who may form a sextet of candidates competing for five seats. This way of thinking is based on the avowed philosophy that a candidate must be elected, if achieving an elective quota, no matter how much other voters may dislike him.

Binomial STV has rather a different slant on the matter. An exclusion quota is not of itself a veto in any one count. Neither is one counts election quota for a candidate complete assurance of election if that is a better result compared to the other counts.

What matters is the over-all result that averages more than one count.

Most simply, a candidate may be elected on an election count but be effectively unelected on an exclusion count. It is the average of these two counts that finally counts - or indeed, the average of two averaged counts in second order Binomial STV. On the other hand, that means that a large enough popularity can out-weigh even a quota of unpopularity.

Admittedly, too great a variation of a candidates keep value from the elective value of unity may make it statisticly unrealistic to suppose that a safely elected candidate or a too little supported candidate can have those decisions reversed to, respectively, unelect or elect him.

Foot-note on the keep value of candidates without any votes:

The keep value of a candidate with zero votes is the quota divided by zero. Zero goes into a number an infinite (∞) number of times. Keep value plus transfer value equals one. So, the transfer value equals one minus infinity: $1 - \infty$.

While infinities may not be unmanagable in an averaging count, like Binomial STV, it is simpler to do without them and they are not really needed or even justifiable. Every candidate might be deemed to have cast a vote of confidence in their candidature, just by standing. Every candidate should have at least one vote, if only their own. In public elections of any size, this is always the case. The problem of zero votes for a candidate could only crop up in small committee elections, where the candidates have been left out from the voting.

One vote is enough to reduce a candidates keep value from infinity to the mere size of the quota. This limit on the size of the keep values, in Binomial STV, makes for a neater comparison between the candidates keep values, without rather meaningless infinities obtruding.

It may be objected why cannot a candidate be free to vote first for someone else?

Well, I don't object in principle, and statistically speaking, it is improbable that any candidate receive no votes. In small scale elections, the candidate not voting for self might well receive no votes, and therefore have an infinite keep value. That seems troublesome. But in practise it is not. The non-supported candidate is clearly out of the running.

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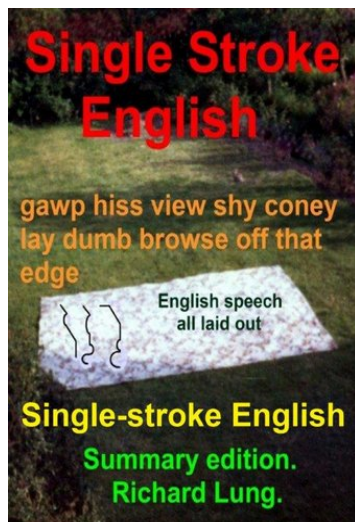
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(Peace-making Power-sharing; Scientific Method Of Elections; Science is Ethics as Electics) are available, also as pdf files:

<https://plus.google.com/106191200795605365085>

Single-stroke English (Summary edition)

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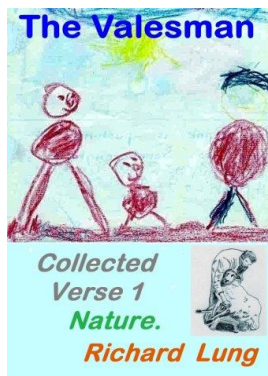
This is the booklet of essentials for learning Single-stroke English. The essential English letters of the alphabet at a stroke -- so far as practical. More memorable than year-zero shorthands. By-passes the hopeless tangle of English spellings.

Guide to five volume collected verse by Richard Lung

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The following descriptions give information on my other books. My up-to-date books list, with links, can be found on my profile page: [here](#).

The Valesman.



The first volume is mainly traditional nature poetry.
(160 poems, including longer narrative verse in section three.)
The nature poet Dorothy Cowlin reconnected me with my rural origins. Many of the poems, about animals and birds and the environs, could never have been written without her companionship.

The unity of themes, especially across the first two sections, as well as within the third section, makes this volume my most strongly constructed collection. I guess most people would think it my best. Moreover, there is something for all ages here.

1. How we lived for thousands of years.

Dorothy thought my best poems were those of the farming grandfather, the Valesman.

2. Flash-backs from the early train.

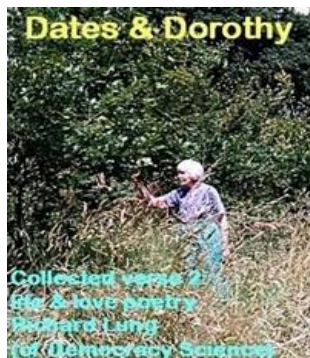
More memories of early childhood on the farm and first year at the village school.

3. Trickster.

Narrative verse about boyish pranks and prat-falls.

4. Oyh! Old Yorkshire Holidays. Features playtime aspects of old rural and sea-side Yorkshire.

Dates and Dorothy



Book two begins with eight-chapter review of works, plus list of publications & prizes by Dorothy Cowlin.
(Seven of these chapters are currently freely available as web pages.)

This second volume continues with the second instalment of my own poems, classed as life and love poetry.

The Dates are historical and romantic plus the friendship of Dorothy and the romance of religion. 169 poems plus two short essays.

Prelude: review of Dorothy Cowlin.

Dates, historical and romantic, and Dorothy:

1. dates.
2. the Dorothy poems.
3. loves loneliness loves company.
4. the romance of religion.

The hidden influence of Dorothy, in the first volume, shows in this second volume. The first two sections were written mostly after she died. Thus, the first section, Dates, reads like a count-down before meeting her, in the second section, as prentice poet.

She was warmly responsive to the romantic lyrics of the third section. This was reassuring because some originated in my twenties. (I gave-up writing formal poetry during my thirties, to all practical purposes. There were scarcely three exceptions.) These surviving early poems, like most of my out-put, under-went intensive revision.

The fourth section probably stems from the importance attached to religion at primary school. Here humanitarian Dorothy's influence

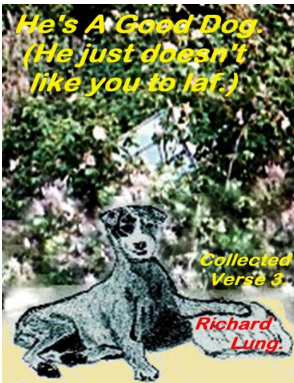
slightly made itself felt by her liking to visit churches.

The prelude review of Dorothy as a professional writer is freely available, at present, on my website: Poetry and novels of Dorothy Cowlin.

Nearly all the text is there, except a preface and last section, which I didn't upload before losing access to the site in 2007. Some of the material, there, has been revised.

The fotos, I took of Dorothy, are published for the first time. The continued availability of my Dorothy Cowlin website is not guaranteed, so I welcome this opportunity to publish my literary review of her work, as an extra to volume 2.

He's a good dog. (He just doesnt like you to laf.)



The third volume is a miscellaneous collection of 163 poems/pieces, making-up sections, one, three and four, with the arts and politics the strongest themes, as well as themes found in other volumes. There is also a story, and a final short essay.

1. with children
2. or animals
3. never act
4. the political malaise
5. the lost
6. short essay:

Proportional Representation for peace-making power-sharing.

One section includes a sort of verse novela and dramatic poem with an eye on the centenary of the First World War. The idea stemmed from an incident related by Dorothy Cowlin (yet again). Her uncle was stopped flying a kite on the beach, because he might be signaling to the enemy battle fleet.

In this miscellany, previous themes appear, such as children, animals and birds. Verse on the arts comes in. I organised these poems on the WC Fields principle: Never act with children or animals.

The fourth section collects political satires from over the years.

The fifth section reflects on loneliness.

This volume is classed as of "presentatives" because largely about politics and the arts, with politicians acting like performing artists or representatives degenerating into presentatives on behalf of the few rather than the many.

However, the title poem, He's a good dog..., hints how eccentric and resistant to classification is this third volume. (There are six dog poems in the volume.) This title poem is based on a true war-time air incident. The good dog is also derived from a true dog, whose own story is told in the poem, the bleat dog (in volume 1).

In the meadow of night



The fourth volume is of 160 poems and three short stories on the theme of progress or lack of it.

part one: allure.

The allure of astronomy and the glamor of the stars.

part two: endeavor.

The romance and the terror of the onset of the space age and the cold war.

part three: fate.

An uncertain future of technologies and possible dystopias. Ultimate questions of reality.

This fourth volume is of SF poetry. SF stands for science fiction, or, more recently, speculative fiction. The verse ranges from hard science to fantasy.

This literary tradition of HG Wells and other futurists exert a strong

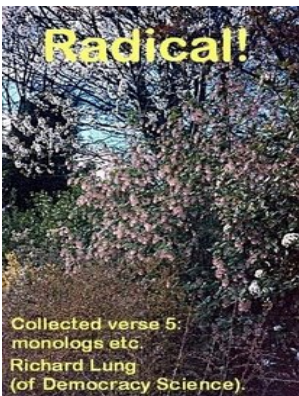
influence.

Otherwise, I have followed my own star, neither of my nature poet friends, Dorothy and Nikki, having a regard for SF poetry.

Yet science fiction poetry is a continuation of nature poetry by other means.

This may be my most imaginative collection. Its very diversity discourages summary.

Radical!



Volume 5 opens with a play (since published in a separate book) about the most radical of us all, Mother Teresa: If the poor are on the moon...

This is freely available, for the time being, on my website: Poetry and novels of Dorothy Cowlin. (Performers are asked to give author royalties to the Mother Teresa Mission of Charity.)

The previously unpublished content consists largely of fairly long verse monologs, starting with artistic radicals, in "The dream flights

of Berlioz and Sibelius," which is a sequence of The Impresario Berlioz, and The Senses of Sibelius.

Next, the intellectual radical, Sigmund Freud, followed by short poems on a sprinkling of more great names, who no doubt deserved longer. (Art is long, life is short.)

The title sequence, Radical! is made-up of verse about John Stuart Mill, Arthur Conan Doyle, George Bernard Shaw, HG Wells, George Orwell and JB Priestley.

Volume five ends with an environmental collection, some are early works, if somewhat revised versions of drafts, currently available on my website, Poetry and novels of Dorothy Cowlin.

If you read and enjoy any of these books, please post on-line a review of why you liked the work.

*My website: Democracy Science.
has current URL or web address:*

<http://www.voting.ukscientists.com>

While preparing this series, I have made minor changes to arrangement and content of the material, so the descriptions of companion volumes, at the end of each book, might not always quite tally.

Seperately from "Radical!" the play about Mother Teresa, also appears as a book, on its own, [here](#).

**If the poor are
on the moon...**



**The Work
of Mother Teresa.**
A Play by Richard Lung.

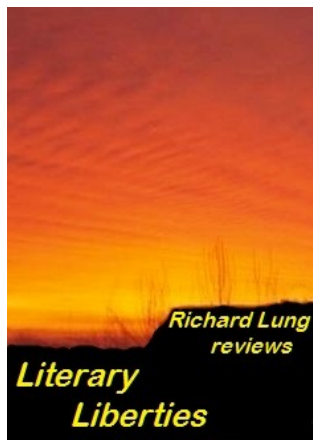
Guide to two more book series.

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The Commentaries series

Commentaries book one:

Literary Liberties



Literary Liberties with reality allow us to do the impossible of being other people, from all over the world. Our imagined other lives make the many worlds theory a fact thru fiction.

This book of books or illustrated reviews span fiction, faction and non-fiction.

It goes some way to substantiate the belief of Benedetto Croce that history is the history of liberty.

I only wrote of books that I appreciated, so that I could pass on that appreciation to others. It must be admitted that I went with novels that looked over horizons confined to family values. (Family is, of

course, a basic trial of liberty, compromised by obligations to partner and children.)

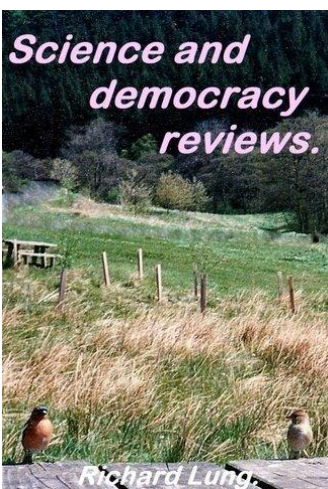
Likewise, these reviews themselves need not be bounded by the horizons of literary criticism but reach out to solutions for the problem novel or the non-fiction book with a cause.

In promoting others writings, I hoped to promote my own, any-way, the liberal values that inform my writings. It took a lot more preparation than I had anticipated. This is usually the case with my books.

Literary Liberties is the first of a series of Commentaries. This author also has a Democracy Science series. The series of Collected Verse was the first to be completed.

Commentaries book two:

Science and Democracy reviews



As they separately pursue their shared ethic of progress, scientific research and democratic reform conduct themselves as two different journeys, both here followed, as the evidence mounts that they depend on each other to meet the stresses that survival poses.

Works reviewed and studied here include the following.

The physicist, John Davidson under-took an epic investigation into the mystic meaning of Jesuses teachings, as for our other-worldly salvation, supplemented by a revelation in non-canonic texts of the gnostics.

The Life and Struggles of William Lovett, 1876 autobiography of the "moral force" Chartist and author of the famous six points for equal representation.

Organiser who anticipated the peace and cultural initiatives of the UN, such as UNESCO.

Jill Liddington: Rebel Girls. Largely new historical evidence for the role especially of working women in Yorkshire campaigning for the suffrage.

"How the banks robbed the world" is an abridged description of the BBC2 program explanation of the fraud in corporate finance, that destroys public investments.

David Craig and Matthew Elliott: Fleeced!

How we've been betrayed by the politicians, bureaucrats and bankers and how much they've cost us.

The political system fails the eco-system.

Green warnings, over the years, by campaigners and the media, and the hope for grass roots reforms.

From Paul Harrison, how expensively professionalised services deprive the poor of even their most essential needs. And the developed countries are over-strained, on this account, drawing-in trained people from deprived countries.

Why society should deprofessionalise basic skills important for peoples most essential needs, whether in the third world or the "over-developed" countries.

The sixth extinction

Richard Leakey and other experts on how mankind is the agent of destruction for countless life forms including possibly itself, in the sixth mass extinction, that planet earth has endured in its history. Why world politicians must work together to counter the effects of global warming.

On a topic where science and democracy have not harmonised, a few essays from 2006 to 2010, after "nuclear croneyism" infested New Labour and before Japans tsunami-induced chronic nuclear pollution. There's a 2015 after-word.

Some women scientists who *should* have won nobel prizes.

Lise Meitner, Madame Wu, Rosalind Franklin and Jocelyn Bell, Alice Stewart, to name some.

Reading of their work in popular science accounts led me, by chance, to think they deserved nobel prizes; no feminist program at work here.

Julian Barbour: *The End Of Time*.

Applying the Mach principle, to an external frame-work of Newtonian absolute space and time, both in classical physics and to Schrödinger wave equation of quantum mechanics, by which the universe is made properly self-referential, as a timeless "relative configuration space" or Platonica.

Murray Gell-Mann: *The Quark and the Jaguar*.

Themes, including complex systems analysis, which the reviewer illustrates by voting methods.

Brian Greene: *The Elegant Universe*.

Beyond point particle physics to a theory of "strings" that may underlie the four known forces of nature, and its material constituents, thru super-symmetry, given that the "super-strings," as such, are allowed to vibrate, their characteristic particle patterns, in extra hidden dimensions of space.

Brian Greene: *The Hidden Reality*.

A survey of the more extravagant physics theories that have invoked many worlds or a multiverse.

Lee Smolin: *Three roads to quantum gravity*.

Reviewing the other two roads (besides string theory) namely black hole cosmology and loop quantum gravity. All three approaches are converging on a discrete view of space and time, in basic units, on the Planck scale. General relativities space-time continuum is being quantised, rather as nineteenth century thermo-dynamics of continuous radiation was quantised.

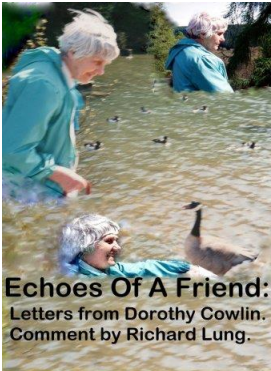
Lee Smolin: *the trouble with physics*.

Impatience with the remoteness of string theory and hope for progress from theories with more experimental predictions. How to make research more effective. Smolin on a scientific ethic. Reviewer criticises the artificial divide academics make between science and ethics.

Commentaries book three.

Echoes Of A Friend: Letters from Dorothy Cowlin.

Comment by Richard Lung.



Dates And Dorothy started with a literary appreciation of the professional writer, traveler, nature walker, and poet, combined with my second book of verse, that includes the story of our friendship.

My second book, about Dorothy, is a memorial, she graces. by speaking thru letters to me, as well as assessments of this writer, she made into a maker and aided as a reformer.

In widowhood, she yet became companionable and widely liked. Her quiet and sunny disposition held in reserve a deeply serious nature.

Commentaries book four:

War from War.



Biography of the authors father, in his faraway origins, over-taken by war, on two fronts, and how to confront it!

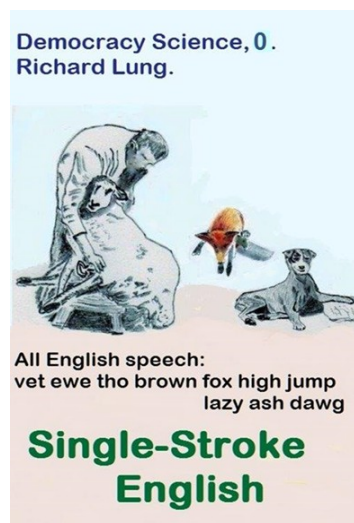
The Democracy Science series.

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The Democracy Science series of books, by Richard Lung, Some material is edited and renovated from this authors pages on the Democracy Science web-site. Some is new.

Book 0:

Single-stroke English (long edition).



This is the long edition of the English short-hand alfabet, with extra information on making English easier to learn and use.

Book 1:

Peace-making Power-sharing.



The first book on voting method, has more to do with electoral reform. (The second is more about electoral research.)
"Peace-making Power-sharing" features new approaches to electoral reform, like the Canadian Citizens Assemblies and referendums. I followed and took part in the Canadian debate from before the assemblies were set-up, right thru the referendums.

This was a democratic tragedy and an epic in the dashing of idealistic hopes.

Some developments in America are reviewed.

The anarchy of voting methods, from the power struggle in Britain, is investigated over a century of ruling class resistance to electoral reform.

A penultimate chapter gives the simplest way to explain transferable voting, on to the more formal treatment of a small club election.

The last chapter is the earliest extant version of my work on scientific measurement of elections (in French).

Book 2:

Scientific Method of Elections.



The previous book had a last chapter in French, which is the earliest surviving version of the foundation of this sequel, Scientific Method of Elections. I base voting method on a widely accepted logic of measurement, to be found in the sciences. This is supported by reflections on the philosophy of science.

The more familiar approach, of judging voting methods by (questionable) selections of basic rules or criteria, is critically examined.

This author is a researcher, as well as a reformer, and my innovations of Binomial STV and the Harmonic Mean quota are explained.

This second book has more emphasis on electoral research, to progress freedom thru knowledge.

Two great pioneers of electoral reform are represented here, in speeches (also letters) of John Stuart Mill on parliamentary reform (obtained from Hansard on-line).

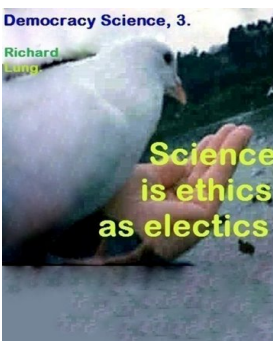
And there is commentary and bibliography of HG Wells on proportional representation (mainly).

Official reports of British commissions on election systems are assessed. These reports are of Plant, Jenkins, Kerley, Sunderland, Arbuthnott, Richard, and (Helena Kennedy) Power report.

The work begins with a short history on the sheer difficulty of genuine electoral reform. The defeat of democracy is also a defeat for science. Freedom and knowledge depend on each other. Therein is the remedy.

Book 3:

Science is Ethics as Electics.



Political elections, that absorbed the first two books in this series, are only the tip of the iceberg, where choice is concerned. Book three takes an electoral perspective on the social sciences and natural sciences, from physics to metaphysics of a free universe within limits of determinism and chance.

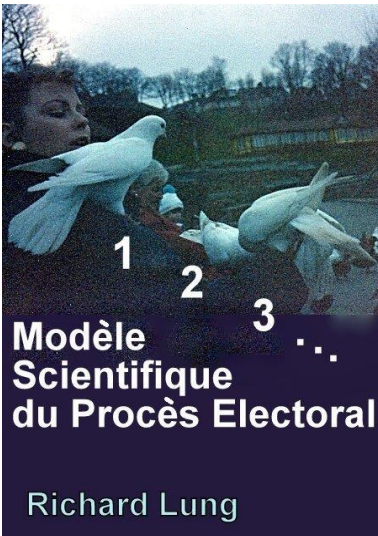
Book 4:

FAB STV: Four Averages Binomial Single Transferable Vote.

General discussions about voting method, followed by a technical account of FAB STV.

In French/En Francais:

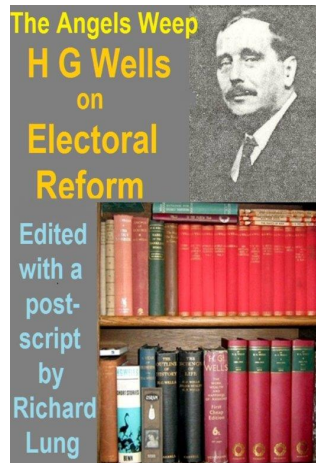
Modele Scientifique du Proces Electoral.



On pourrait considérer le problème de la représentation comme va problème scientifique de mesure. Pour cela, il y a à notre disposition quatre échelles possibles pour mesurer la représentation. L'échelle classifiée ou nominale, l'échelle ordinale, l'échelle à intervalles, et l'échelle à raison.

Le scrutin transférable (ST, ou STV, en anglais) est un système coordonné du vote au dépouillement, dans un ordre de préférence empirique 1, 2, 3,.. à l'ordre rational de 1, 2, 3,.. membres majoritaires.

The Angels Weep: H.G. Wells on Electoral Reform



The never bettered reality show of the role of domestic power politics in the misrepresentation of the people.

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